Rock Products

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This Virginia Stone Operation Is Electrically Powered Throughout

Although Located in an Isolated Mountain Section, the Plant and Quarry of the Liberty Lime and Stone Co., Rocky Point, Va., Are Equipped with Electrically Operated Machinery, Which Turns Out an Average of 800 Tons Per Day

WITH a plant built along modern lines, made up of machinery and equipment similar to that used at the newest operation in the country, and with a quarry which it operates with the most modern equipment, the Liberty Lime and Stone Co., Rocky Point, Va., is operating six days of every week; producing an average of 800 tons of crushed limestone for commercial and agricultural purposes daily.

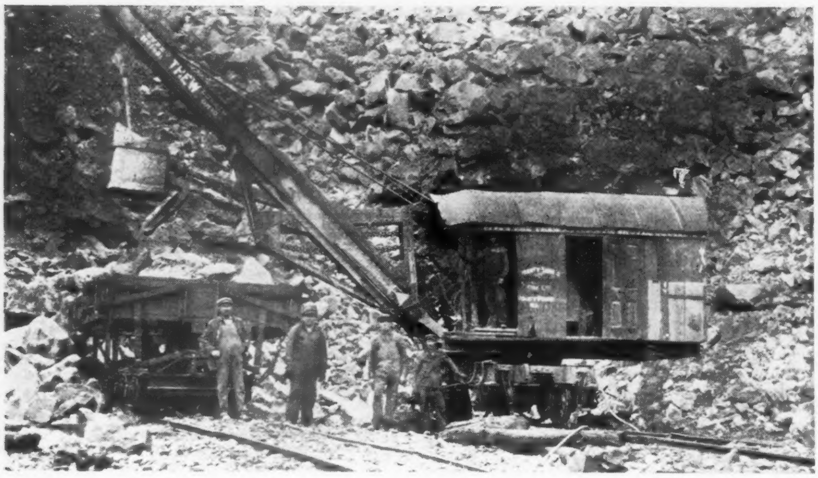
In visiting the Liberty company's operation and realizing its location—several miles from the nearest town or village, over winding mountain roads—one wonders how it is possible that such a truly modern operation was ever effected. To go to the quarry, however, is to understand what warranted the building of such a plant. A deposit of limestone 125 ft. high, with practically no overburden, opened to a length of 200 ft., is the answer. An average analysis of the stone shows it to contain: $CaCO_3$, 97.08; $MgCO_3$, .85; SiO_2, 1.52, and iron and alumina oxide, .48.

The quarry itself is perhaps the most interesting part of the entire operation. It is operated with electrically powered machinery throughout with the exception of the drilling equipment. The shovel is a No. 3 Thew, automatic circle swing, electrically driven, equipped with a 1½-yd. bucket. One shovel is used because of the short length of the face. This face, however, is being lengthened and a second shovel, of the same type as the one now in use, will be added.

This plant, although in an isolated section in the mountains, is electrically operated and of unusual design

The quarrying method employed is unusual. The track from the plant runs at right angles to the face. At a point approximately 300 ft. from the face the main line branches into five tracks, each of which extends to the face. Two of these tracks are used for storing extra cars. Whenever the plant stops, due to breakdown, and the two regular trains have been loaded, the surplus cars can be loaded to avoid a loss of time in the quarry.

Only two cars can be loaded on each track at one spotting. Accordingly, when



This electrically powered shovel loads all of the stone that goes through the plant

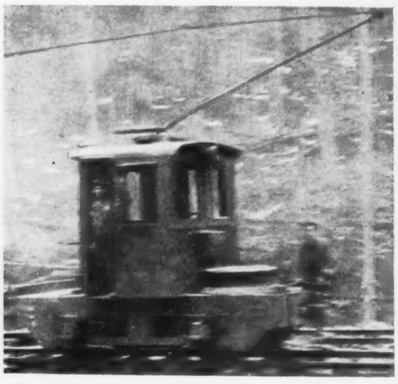
the locomotive has placed two empty cars on one of the tracks at the shovel, it gets two more and spots them on the track on the opposite side of the shovel; when the other two are loaded, it replaces them while the shovel loads the other two, and so on. Consequently, the operation is continuous. When the locomotive is at the

The face is 125 ft. high. Note the trackage arrangement

plant with a train, a small two-drum hoist, powered by air, is used to shift the empties back and forth to the shovel.

The locomotive is a General Electric, 15-ton, 550-volt, trolley type, with air-brake equipment, and handles from six to ten 6-yd. Continental two-way dump cars to the train. Owing to the necessity of changing the quarry tracks from time to time it is impossible to extend the trolley line into the quarry. To make possible its entrance, the locomotive is equipped with a self-winding reel on the back end which accommodates several hundred feet of cable. The cable end is fastened to a hook on the end of a wooden pole and the trolley is taken from the wire, the wooden pole and cable serving as an extended trolley. In this way the locomotive can go to any desired point in the quarry.

Drilling is done by Ingersoll-Rand



When the locomotive reaches the end of the trolley line a cable from a reel on the back end is hooked to the trolley and it continues into the quarry

Jackhamer drills and by hand drills, the present stages of the quarry's development not justifying a well-drill installation. Air is furnished for the small drills and the hoist by a 9x12-in. Sullivan compressor powered by a 50-hp. motor. Provision was made during the installation of this unit for an additional compressor, to be installed later.

The quarry is one mile from the crushing plant, the two being connected by a ballasted standard-gage track at a grade of 2.65 per cent for 4000 ft. from the plant and the remaining distance into the quarry at a level grade. This track is built along the edge of a mountain practically the entire distance. As the trainloads are brought in from the quarry they are taken beyond the crusher and pulled in to the dumping-point. This track is laid at a 1½ per cent grade in favor of the loads to the plant.

Cars are dumped direct and in rapid succession into a 5x12-ft. Sheridan grizzly feeder, manufactured by the Traylor Engineering and Mfg. Co., which feeds a 42x48-in. Traylor jaw crusher. These units are driven by a 150-hp. motor. As a great part of the company's business calls for flux and lime-kiln stone—ranging in size from 1 to 8 in.—one-half the product of the primary crusher is chuted direct to a 72-in. by 20-ft. revolving screen, the first three sections of which have 1-in. perforations and the last two, 6-in. rings. As the primary breaker is set to discharge at 8 in., the rejections of this screen (6 to 8 in.) are chuted to a separate bin.

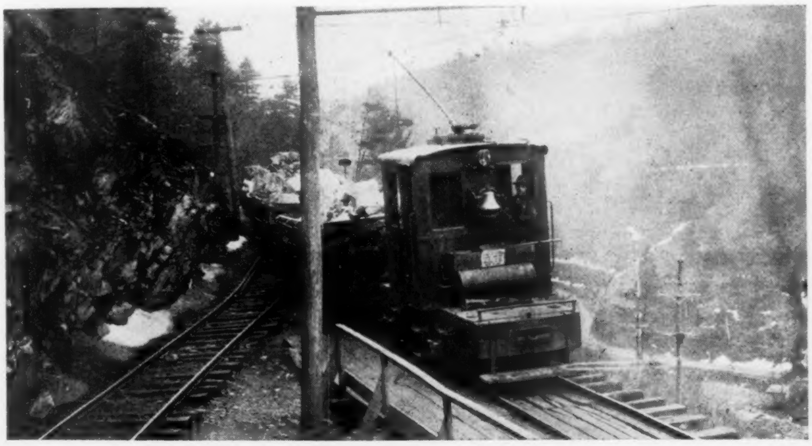
How the drilling is done. The ledge on which the man is standing is 40 ft. above the quarry-floor level

This size is sold as lime-kiln stone. That which passes through the 6-in. rings is chuted to another bin and sold as flux. The first two 1-in. sections of this screen are provided with outer screens of ¾-in. perforations. The product of these sections is moved by gravity to a 42-in. by 10-ft.

screen having two sections with ⅜-in. perforations and one section of ¼-in. holes. The material passing through the 1-in. perforations of the three sections of the large screen, which does not pass through the ¾-in. outer jacket, is chuted to a separate bin and sold as a special size for commercial purposes. The product of the small screen is discharged on a 14-in. belt conveyor of 76-ft. centers which carries it to a pulverizer. The screens and conveyors in this part of the plant are driven from a single line shaft powered by a 40-hp. motor.

Only one-half of the product of the primary breaker is put through the foregoing process. The other half is chuted from the crusher direct into a 16-in. Traylor gyratory driven by a 100-hp. motor. This machine is set to discharge at 3½ in. and empties on a 24-in. conveyor of 32-ft. centers leading to a 72-in. by 20-ft. revolving screen of five sections—one 3½-in., one 2½-in., and three 2-in.—having a two-section outer jacket of ¾-in. perforations. The product of the outer jacket of this screen is chuted to the 42-in. screen fitted with ⅜ and ¼-in. perforated section. The product of the inner or main barrel is chuted into bins according to size. This screen is individually driven by a 25-hp. motor.

Extending the quarry. Preliminary excavation is being done by hand as a shovel could not be put in until a fill is made



Coming in with six cars—approximately 45 tons. Note the elevation at this point

Grizzly and Screen

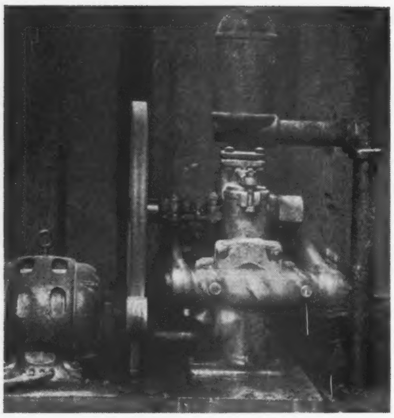
Immediately below the grizzly feeder is mounted a 42-in. by 6-ft. revolving screen of ⅜-in. perforations. This screen is designed to take care of the material which passes through the grizzly. About one-half of the material coming from the grizzly to this screen is dirt and small stone—spalls. The dirt is separated from the stone by a 2-in. stream of water furnished by a 5x5 Goulds pump. The waste water and dirt removed here are carried away in a 4-in. pipe and the material retained on this screen is chuted to the conveyor leading from the secondary crusher to the sizing screen.

All material passing through the ¾-in. outer jackets of both screens is chuted to a 42-in. by 10-ft. screen of ⅜ and ¼-in. perforations and the stone passing through it is carried by a belt conveyor to a pulverizing plant. The plant has one No. 3 Williams pulverizer. The dust discharged from this machine is elevated and emptied on a National vibrating screen fitted with removable panels of copper woven wire fine mesh screen.

Laboratory Tests Show That the Pulverization Is Efficient

Laboratory tests show that more than 50 per cent of the product of this screen will pass through a 200-mesh screen and that only ⅕ of 1 per cent will be retained on a 10-mesh screen. This material is stored in a 50-ton damp-proof bin. It is

Dumping into the grizzly feeder. Six cars are dumped in rapid succession. "Choke-ups" are unknown here

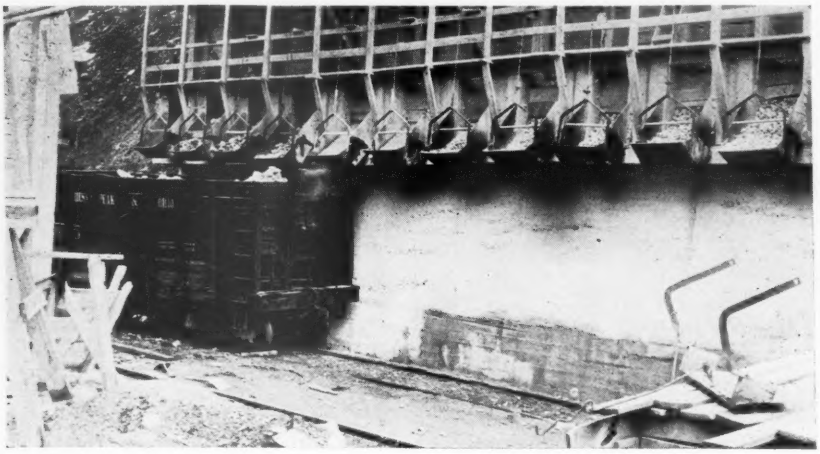


This outfit furnishes a 2-in. stream to the small screen which takes care of the small sizes from the grizzly

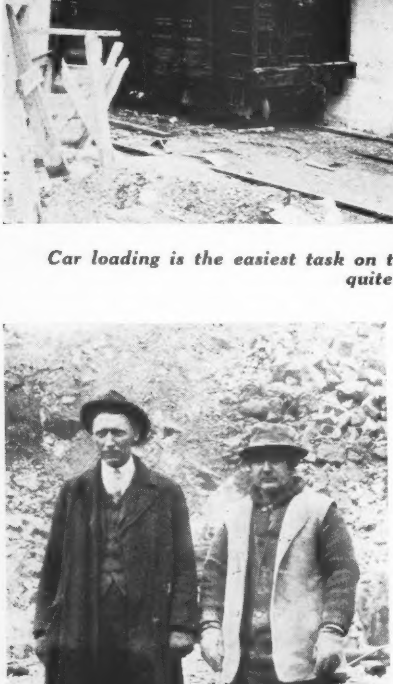
removed and sacked by hand and sold as agricultural limestone.

Owing to the lack of drying equipment, the agricultural equipment cannot be operated during the winter months or during wet weather. The present plan is to install a rotary drier this season so that the plant can be operated throughout the year. Among other equipment which will be installed later is a second No. 3 Thew electric shovel with a 2-yd. bucket and a gasoline locomotive to replace the hoist now in use in the quarry for switching cars.

The Liberty company is a wide-awake organization and is counted among those which are first in taking forward strides. Major J. W. Stull, president and general manager, is a veteran in the crushed stone industry and is always present when the roll is called at convention time. Major



Car loading is the easiest task on the job. A 15-year-old boy handles it quite easily



At the left, Major J. W. Stull, president and general manager; right, C. L. Arehart, superintendent

Stull is active in the general direction of the operation but is relieved from the details of the plant management by C. L. Arehart, general superintendent.

The Prospect for Oil Shales

LAST October, after six years of experimental study, the Elko Oil Shale Products Company, near Elko, Nev., was mining and refining shale at the rate of 144 tons a day—at a small margin of profit, so it is said, though Mr. R. M. Catlin, the owner, admitted that his work was too new to tell how profitable or unprofitable it might prove. It is declared that this plant reprecents the nearest approach, in this country, to anything like commercial production.

Oil shales have been exploited in Indiana, Ohio, Kentucky, California, and Montana. In none of these states, however, has the operation of mining or retorting been started in what might be called a business way. Activity, however, is looked for in them all in the near future, for oildom is thoroughly aroused to the need. In Kentucky there are at least two large companies that have signified their intention of beginning operations; and the same may be said of California.

In Colorado, 26,000 acres of oil-shale lands have been patented. Several retorts have been erected there, and mining and refining processes are in operation, though not, as yet, on a commercial scale.

The average yield there amounts to about 42 gal. (one barrel) of oil per ton of shale —the American average being somewhat below that figure. In Esthonia, shales running 77 gal. per ton have been found, while in Australia, shales as rich as 180 gal. with a minimum of 80 to the ton have been mined and distilled.

Practically every large oil company in the world has already secured extensive holdings of American oil-shale deposits and is or has been conducting scientific field and laboratory research in what is recognized as a coming industry. This is evidence that big oil producers foresee the potentialities of the business, and that they realize it is well to throw an anchor to windward.—*Compressed Air Magazine (Abstract).*

Building in Winter

IN recent years much has been written about the economic desirability of lengthening the construction season. It has been pointed out that if workmen and construction plant are idle one-third of the time (and it averages longer) then the labor cost of construction becomes 50 per cent more than it would be were it possible to keep them continuously employed. The income of both labor and capital, in the final analysis, must be reckoned by the year; and if only 200 of the 300 available working days in a year are actually worked, the cost per diem, both for wages and for fixed charges on the construction plant, is greater by one-half than it would be were the full 300 days made productive.

This economic argument in favor of continuous building construction is unanswerable, provided a day's construction cost in the winter does not greatly exceed a day's construction cost in summer. We are sure that, with fairly good roads, with modern machinery and devices, with building materials that can be safely used in freezing weather, winter building can be almost, if not fully, as economically conducted as summer building; and that when consideration is given to all the elements of cost (such as labor efficiency, adequate labor supply, promptitude in delivery of materials, interest charges on tne land and building up to the time of occupancy) then winter building construction becomes so clearly economic that even the most deep set habit of aversion to it cannot survive.

It seems to us that every architect, every structural engineer, every building contractor, should submit estimates of building cost to his clients, demonstrating the real economy of the all-the-year-'round construction.—*Buildings.*

The Acme of Gravel Plants

Springfield-Pekin Gravel Co.'s New Installation of Dredge and Washing Plant Is a Model in Design and Construction

By Charles A. Breskin

THE new plant of the Springfield-Pekin Gravel Co. is just outside of Pekin, on a 300-acre tract, of which 150 acres have been proven to be a workable gravel. This is in a prosperous industrial and agricultural district of Illinois, where a ready market for its product is found for both highway and structural uses.

In appearance and construction, as well as in the design and layout, this plant comes as near being the ideal as any that has come within the writer's knowledge. While the flow sheet is simple, it is of that simplicity that comes from eliminating the non-essential, and the construction shows that true economy dictated the design, steel and concrete being freely used wherever they were better for the purpose than timber.

Glacial Deposit

This plant adds another to the long list of important producers on or near to the great terminal moraine which marks the farthest south of the Pleistocene glaciers. The deposit has been proven by borings to have a depth of at least 50 ft. and is about 65 per cent gravel and 35 per cent sand. In common with other moraine deposits it contains a considerable proportion of cobbles which require crushing.

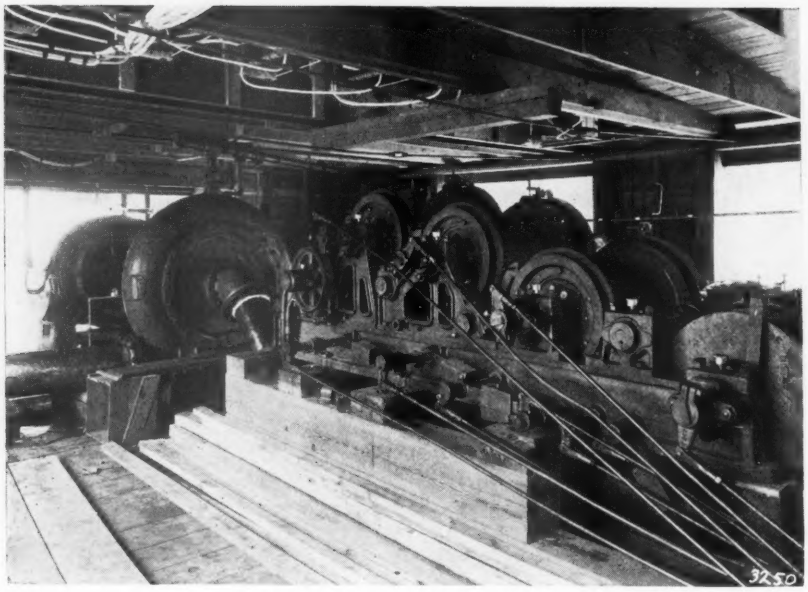
The company estimates that the deposit contains sufficient material to last for 50 years, at the present rate of production, which is 2500 tons per day. With such a deposit and market, the company was amply justified in investing in a plant of which permanence and solidity are more apparent than in the usual plant design.

Dredging was the method chosen for excavating the sand and gravel, and a dredge was built from the design of W. H. K. Bennet. The hull, 55x24 ft., is of timber, and it was not built on the shore and then launched but built on the ground, and then an artificial lake was created around it.

The layout of the dredge is shown in the drawing on page 26. The main pumping unit

Discharge end of dredge, showing start of the 12-in. 1400-ft. pipe line going to the plant. This line is shortened as the dredging proceeds. No pontoons are needed to support the line

General view of the shore plant of the Springfield-Pekin Gravel Co., Pekin, Ill. It has a capacity of 2500 tons of washed sand and gravel produced in eight hours and is entirely automatic in its operation



This hoist, direct connected to a 50-hp. motor, raises and lowers the dredge spuds and handles the boom that supports the suction

is a 12-in. Amsco pump direct connected to a 400-hp. induction motor. It operates on 2200-volt 3-phase 60-cycle current. Both suction and discharge pipes are 12 in. in diameter and the normal static head against which the pump lifts is 32 ft.

Priming is accomplished by means of a 2-in. Dayton-Dowd centrifugal pump direct connected to a 10-hp. motor.

Controling the Dredge

For moving the dredge and handling the suction a Clyde hoist with three single drums and one double drum has been installed. As is shown in the layout drawing of the dredge on page — the levers which control the drums are brought forward to where the dredgemaster stands, with the pump control on his right-hand side.

This dredge is provided with spuds for holding it in position and two of the single drums are used for raising and lowering these. The third single drum handles the suction. The double drum is used for swinging the boom (that supports the suction) from side to side, enabling the suction to move through a considerable arc without swinging the dredge. All the drums on the hoist are operated by a 50-hp. motor.

A rope from the flap valve of the pump leads to the same point as the hoist lever and pump control, so that the entire handling of the dredge may be done by one man. However, a helper is provided, his duties being to oil the machinery and to clear the suction nozzle when it gets stuck.

Pipe Line Shortens

At the time of the writer's visit, the discharge line extended 1400 ft. to the screening plant. This is the greatest length of discharge line that will be used. As excavation continues, the dredge will be moved in so that the pipe line will be *shortened* instead of lengthened, as is the more usual practice. There are some decided advantages to this "retreating" method of working. One of them is that the line is wholly supported on the shore, without the use of pontoons, and others are that there is no waiting for pipe that has been ordered and no time is lost in making extensions.

Just before reaching the screening plant, the discharge line makes a 90-degree turn, and starts to rise. After rising 13 ft. it discharges into a steel flume which is 5 ft. 10 in. wide, 22 in. long and 18 in. deep, and made of ⅜-in. steel. The last 9 ft. of this flume, nearest the plant, are perforated with 1x½-in. holes.

Preliminary Screening in Launder

The material which passes these holes drops into a wooden flume underneath and flows to a concrete sump, or elevator pit. The coarser pieces which do not go through the perforations are carried into a 60-in. by 10-ft. revolving screen, with 2-in. perforations. All that passes these 2-in. holes joins the fines in the wooden flume mentioned, while the oversize pieces (larger than 2 in.) are carried by an elevator to the oversize stone box. The arrangement of screen and elevator is clearly shown in the drawing on the opposite page.

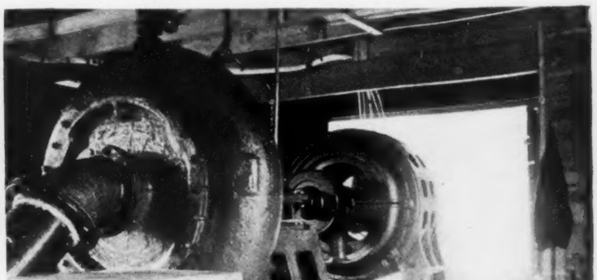
This elevator, which is 35 ft. between centers, has 8x12-in. overlapping buckets, on a single-strand chain. The chute feeding the elevator is arranged to give a very positive feed to the passing buckets.

Stone Box and Crusher

Not all the water is removed as the material passes over the perforated steel flume. Enough remains to aid in removing the fines in the revolving "stone" screen that follows.

An offset chute carries the stone from the elevator to the oversize stone box. This stone box has 2 yd. capacity and a gate which may be set by a rack and pinion. The stone flows through this gate to a No. 5 Austin gyratory crusher which reduces the stone to 2-in. size. The discharge from the crusher goes to the wooden flume which feeds the elevator pit.

The stone screen and elevator are chain driven from a 15-hp. motor and the No. 5



On the left, suction end of dredge showing A-frame and boom that supports the suction. The boom is swung by the hoist, shown above. Right, 12-in. centrifugal pump direct connected to 400-hp. motor. It is manganese steel lined

gyratory crusher is belt driven from a 25-hp. motor.

Between the wooden flume and the concrete sump or elevator pit there have been placed baffle boards to deflect the flow of the water as well as to facilitate the precipitation of the sand in the elevator pit. The baffles also prevent the water from running beyond the dredging elevators and over the weir.

Details of Concrete Construction

The concrete sump or elevator pit is 45 ft. long over all and 19 ft. wide. These dimensions include the spillway and retaining wall. The sump has a 15-in. concrete wall on the outside, while the portion along the spillway is 24 in. The dividing walls between the elevators sumps and sumps and the weir are also 12 in.

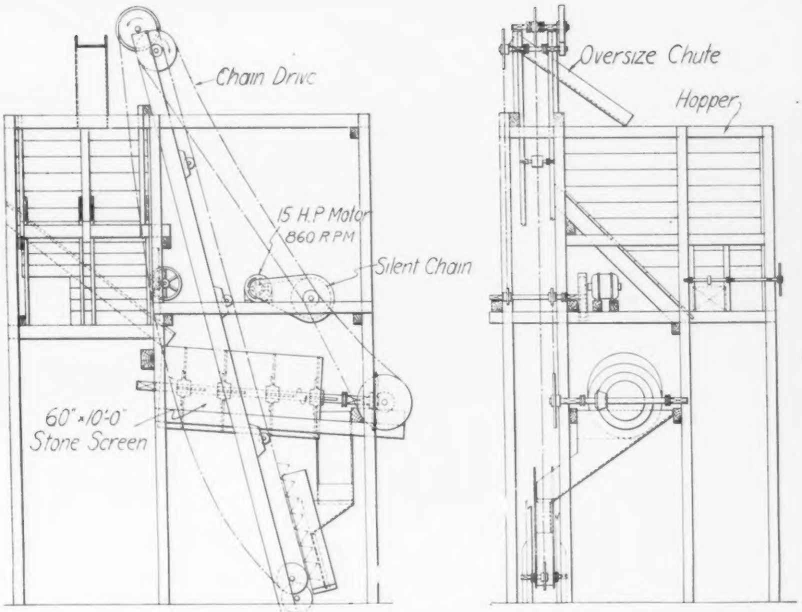
All the walls of the sump, except that of the weir, are 7 ft. above top of the floor and the floor is 12 in. thick. The floor in the spillway is also 12 in. thick and has a slope of 2 in. toward the discharge end of the flume.

The footing course under the tower and weir from a point 10 ft. back of the walls into the elevator sumps is 36 in. in thickness and is given a spread of 9 in. beyond the approaches of wall on either side. The balance of the footing under walls in the elevator sumps are not less than 24 in. in thickness and of the same width on either side of the face of the wall. This precaution in construction was necessary to prevent settling.

Excellent Drainage System

The sand falls to the bottom of the sump while the water goes over the weir into the spillway and into a concrete catch basin and thence to the tile drain which carries the water to the waste pond. The catch basin is 2½ ft. below the top of the floor in the spillway and the flow line of the tile drain is flush with the floor in the catch basin.

This tile drain is constructed of 24-in. tile and has a drop of 2 ft. in 100 ft., which is sufficient to take care of the flow of water from the pumps, sand screens, launders and also of the drippings from the tanks or loading bins. The tile, apparently, flows 8/10 full, which gives the wetted perimeter for maximum velocity.



The stone screen receives its feed from a perforated steel flume, shown below. The oversize from this screen is fed to the elevator and goes to the hopper from which it goes to the gyratory crusher (not shown here)

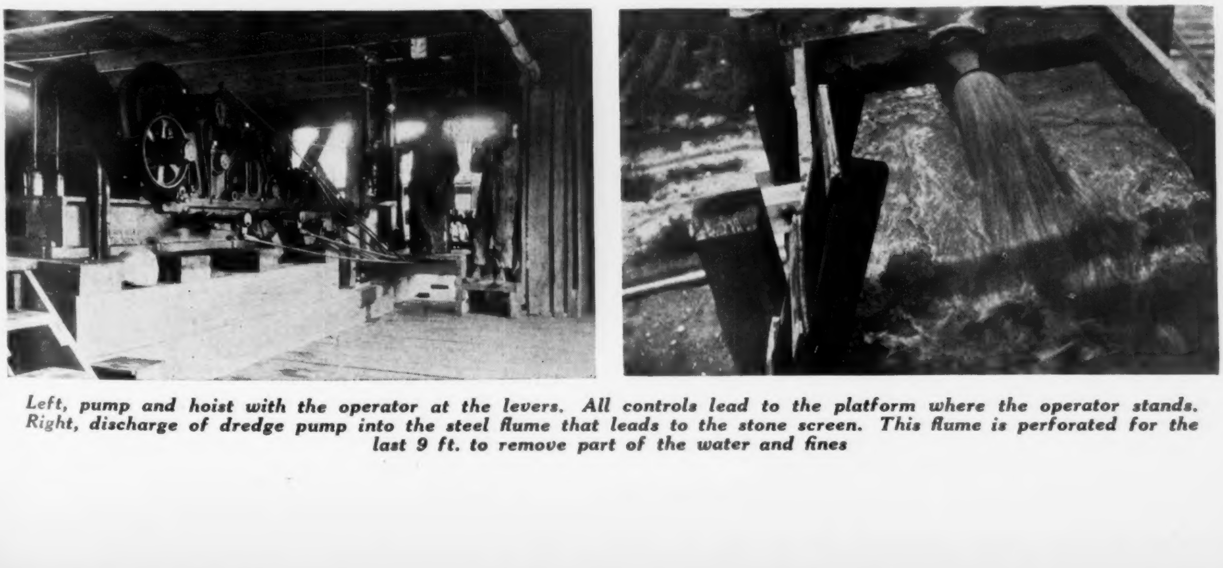
Two elevators of 68-ft. centers recover the material from the sumps and carry it to the top of the screen house for final washing and grading. These are of the type known as dredging elevators and have special ingot iron buckets. The links and rollers are made of the same material, to insure maximum service under the severest of conditions. The buckets are placed 18 in. apart, there being 102 buckets to each elevator. The speed is 77 ft. per minute.

Special Dredging Buckets

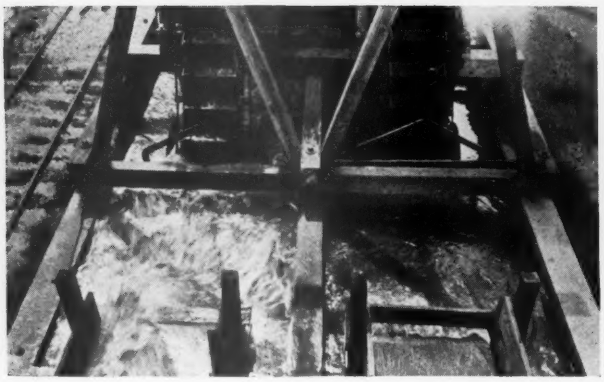
A feature worth special notice is the construction of the re-enforced lips of the dredging elevator buckets. These are made of manganese steel. As can be seen from the accompanying photograph, one lip projects outward; this is the digging bucket. The other projects inward and is the dragging bucket. In other words, the first bucket digs the material and cuts a partial path for the second bucket to catch the loosened material. It is said that this type of elevator construction cuts the power consumption to half of what the old style elevator would take.

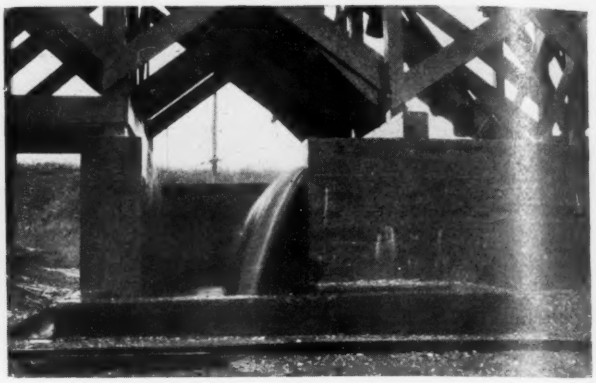
The elevator buckets discharge at the head end into a steel chute made of ⅜-in. plate and extending from a point 7 in. out of the elevator bucket into the first conical screen. The chute is fan-shaped, is 12 ft. long and has a fall of 1 ft. 8 in. from end to end.

The two elevators operate as separate units and are independent of each other. Each unit has its own set of screens, made up of three conical screens, 72x36x76 in.



Left, pump and hoist with the operator at the levers. All controls lead to the platform where the operator stands. Right, discharge of dredge pump into the steel flume that leads to the stone screen. This flume is perforated for the last 9 ft. to remove part of the water and fines





Left, concrete sump, which receives discharge from stone screen and initial steel flume, and dredging elevators. Only one elevator was working when the photograph was taken. Right, the spillway from sump to the catch basin which is drained by the tile drain

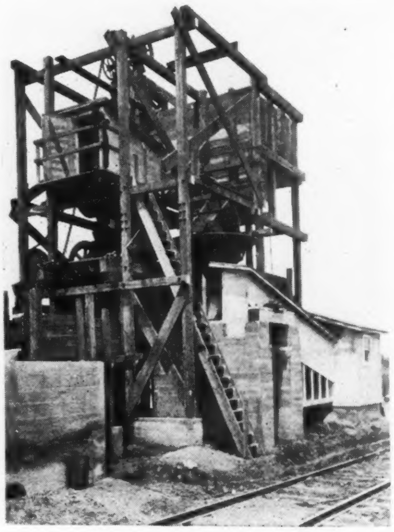
operating at a speed of 10 r.p.m. The first screen which takes the discharge from the dredging elevator has 1¼-in. perforations; the second ⅝-in. and the third ¼-in. perforation. Each line of screens is followed by three 72-in. Dull sand separators.

The Screen System

In the first screen the material 1¼ in. and over is spouted to bin No. 1, while the undersize falls into a 3/16-in. steel water pan. This pan extends from a joist on either side of the screen allowing no material or water to fall into the bin below and it sets with enough pitch to run the material readily into the next screen. Between screen No. 1 and screen No. 2 the water pan has a covered peak top; between screen No. 2 and No. 3 the same type pan is provided.

For Concrete Mix

The discharge of screen No. 2 gives to bin No. 2 and that of No. 3 to bin No. 3. The undersize of screen No. 3 goes through steel flumes to conical sand separator No. 1, located over bin No. 3. A quadrant gate is placed in the flume to admit the material to separator No. 1, which is only used when sand is required in bin No. 3, which is the *concrete mix bin.* Otherwise the material is carried by to sand separators Nos. 2 and 3. A perforated bottom in the steel flume over separator No. 2 is provided, with ⅛x¾-in. perforations. The undersize goes to separator No. 2 discharging to bin No. 4 and the oversize to separator No. 3 discharging to bin No. 5.

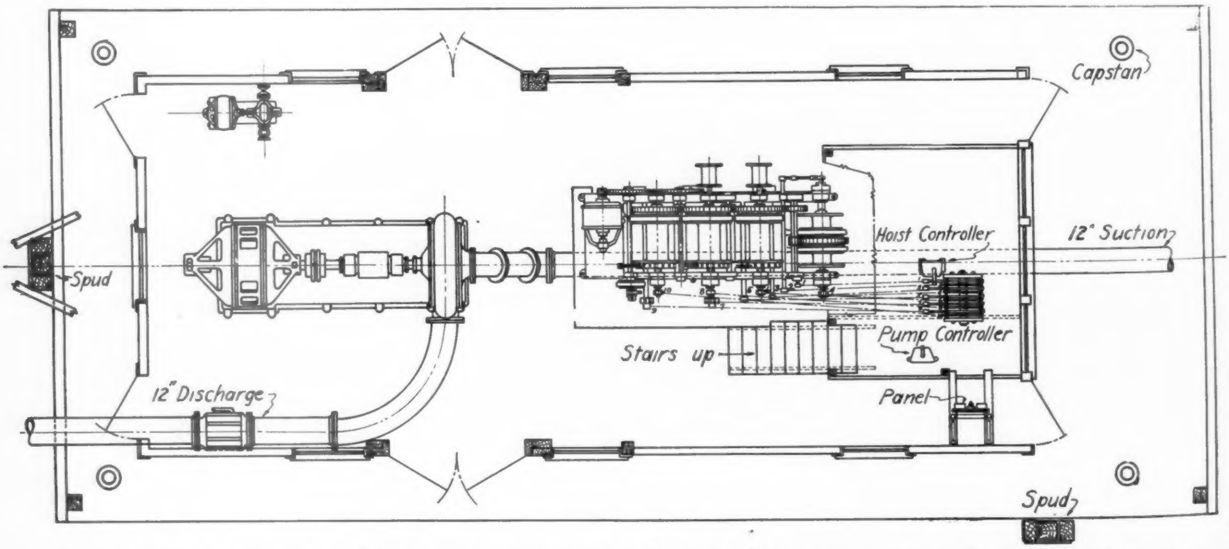


No. 5 gyratory crusher which crushes oversize from the stone screen. The crushed stone joins the fines

Drainage of Overflow from the Sand Separators

The sand separators have launders which take the excess water and discharge it through pipes to the concrete gutter at the base of the loading bins. The gutter flows into the tile drain to the elevator sumps.

An arrangement of spouts and gates, shown in the drawing on page 28 permits the material from any screen to be routed to any of the first three bins as desired.



Layout of dredge, showing positions of the pump, motor hoist and priming pump. The hull is only 55x24 ft., but there is ample room for the operator to get to all parts of the machinery

Left, the pipe line entering the steel flume; the stone hopper and crusher. Beyond, the concrete sump and the dredging elevators. Right, the loading bins and spouts. The white lines are stand pipes that take the overflow from the sand separators and deliver it to the catch basin and tile drain. The middle bin for concrete mix

Such an arrangement allows for the mixture of any size material in the loading tanks. As mentioned previously tank No. 3 is for loading *concrete mix*, and has a sand separator directly over it.

Bins No. 1, 2 and 3 are 40 ft. high, 20 ft. inside diameter and constructed of steel plate. Bins No. 4 and 5 are 30 ft. high and 20 ft. inside diameter. Welded to the top of the tanks are 12-in. I-beams, which support the superstructure. Four angle iron stiffeners, 5 in. by 5 in. by 4 ft. in length were welded onto the top sheet of each tank, to prevent buckling.

Double Loading Track

Each loading bin has two discharge spouts on either side, there being a loading track on either side of the plant. The spout openings in the bins are 18x18 in. and are 16½ ft. above bottom of bin.

Bins No. 1, 2 and 3 have gravel gates, while 4 and 5 have sand gates. Car loading chutes are constructed of steel plate, 22x7 in., and are suspended by steel cables at the outer ends. They are counter weighted, the cables running over 7-in. sheaves, hung from the top ring in each bin. The center of the loading track is maintained at 9 ft. from the face of the bin. The total loading capacity of the 5 bins is about 1500 tons.

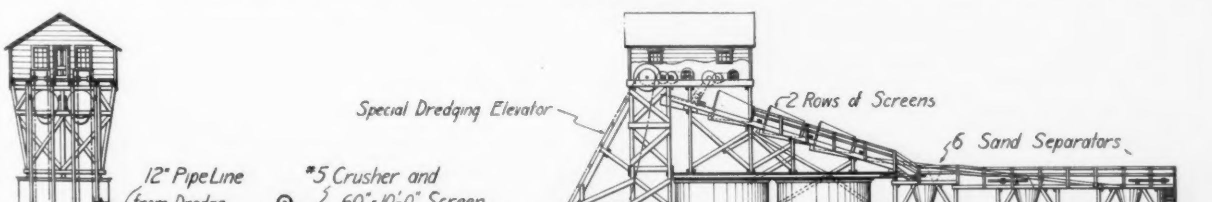
Top of screening plant showing screens and sand separators. Each of the two screening units is independent of the other

Water Supply

Water for washing purposes and fire protection is supplied by a 6-in. Dayton-Dowd centrifugal pump direct connected to a 100-hp. induction motor. The pump has an 8-in. suction line extending into a 5-ft. well, 36 ft. deep.

The well has a 3/16-in. steel shield, the bottom 6 ft. of which has ½-in. round perforations on 2-in. centers. The bottom is left open and water comes up through the gravel which acts as a natural filter. The pump at full capacity is rated at 1500 g.p.m. and has a 6-in. discharge line which is expanded to 10 in.

The 10-in. line from the pump pit extends for a distance of 31 ft. to a straight stand pipe 39 ft. high, from the top of which it runs as a horizontal 10-in. line over the top of the superstructure on the screening and washing plant. At a point 3½ ft. below screen No. 3, the 10-in. line branches out right and left through 6-in. pipe to the working platform on either side of the structure adjacent to the screens, a 2½-in pipe being led off on either side to screens No. 3. Water is supplied to two 45 deg., 1½-in. street elbows, reduced to ½-in. open-

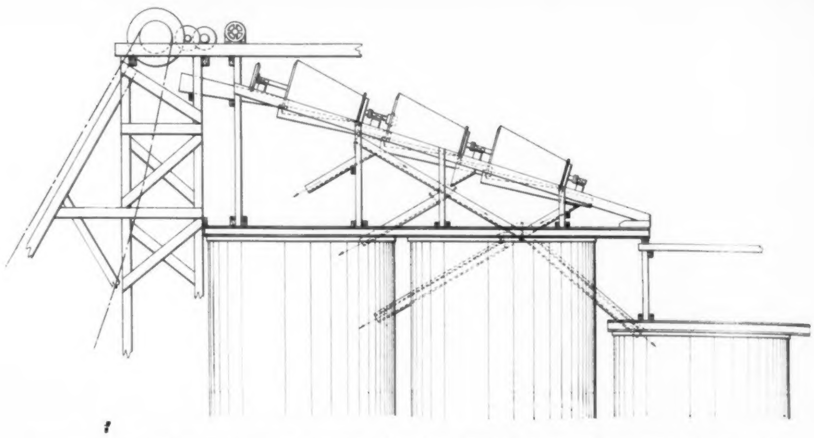


General elevation showing the pipe line from the dredge, the stone screen and hopper, concrete sump with dredging elevator and the screens and sand separators with the bins below

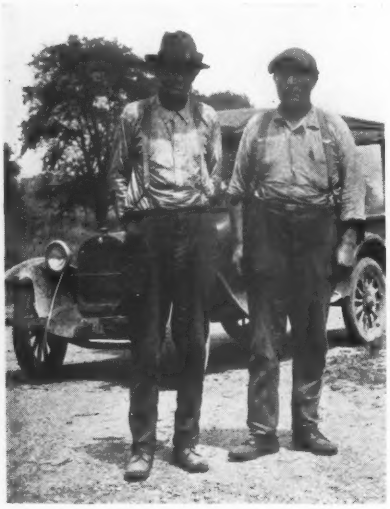
ings which gives a jet in the screen for rinsing the material.

Fire Protection

The 6-in. line is carried on through to a point below screen No. 2 where 2½-in. pipes are led off to supply jets with water. At this point the pipe is reduced to 5 in. and runs to a point below screen No. 1, where another 2½-in. pipe is led off for jets. A 4-in. line is carried from this point through to heads of dredging elevators, with a 4-in. drop, to supply water for chutes from elevator heads to first screens. This is to facilitate sluicing of material.



Arrangement of chutes from screen showing how the gravel is carried into the concrete mix bin. The sand for this mix comes from a sand separator above the bin (not shown here)



On the left, John Sours, president, Springfield-Pekin Gravel Co. On the right, J. E. McClanahan, superintendent

Fire hose valves are provided opposite the first countershaft in the screen drive and on working platforms of outside of structure, for fire protective purposes. Another fire hose connection is provided for at head end of 10-in. line from the pump house, at a point where 6-in. distribution lines are taken off and just below screen No. 3. Also, a valve is provided for in the dump house adjacent to the pump and at a point immediately below a 10-in. gate valve which may be closed, if necessary, and the full capacity of the pump thrown into the fire hose connection.

All jets in the screens are controlled through 2½-in. gate valves placed in their respective supply lines. Four-inch gate valves are provided in each line to supply water to the chutes from the dredging elevators, thereby allowing control of water at this point.

Both Dredge and Washing Plant Are Electrically Powered Throughout

The plant is electrically operated throughout, the power being purchased from the Central Illinois Light Co. The power comes in at the main transformer station of the plant, consisting of three 75-kva. transformers, at 13,200 v. and is stepped down to 2300 v. and 440 v. The 2300 v. line runs to the dredge and provides current for the pump. The dredge has a separate transformer reducing the current to 440 v. for hoist and pump priming motors.

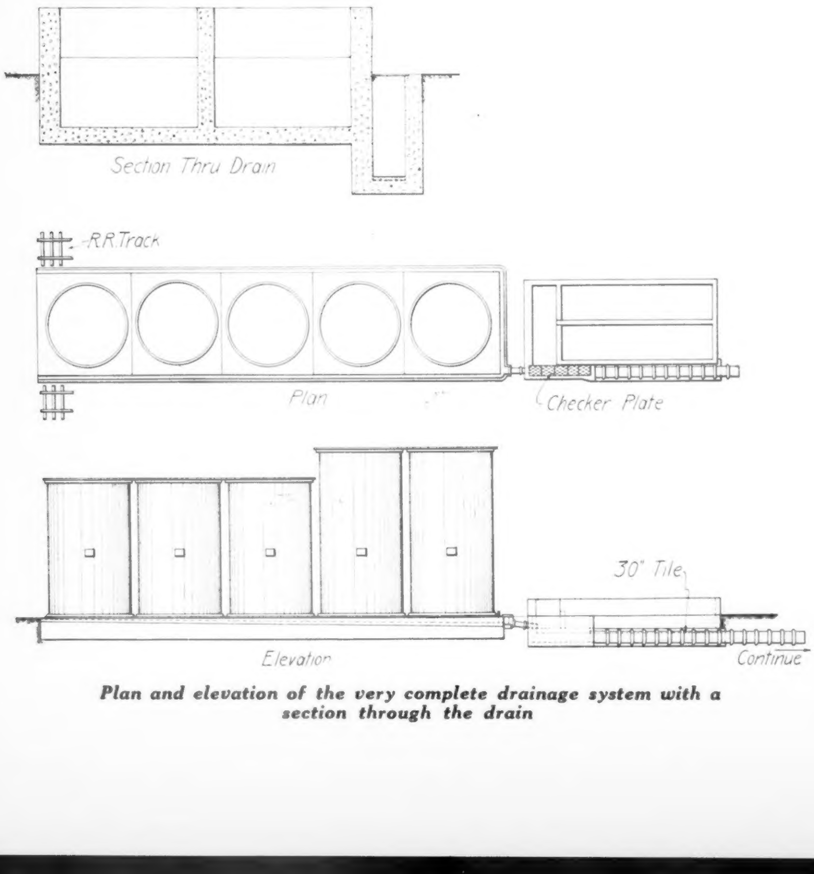
All current in the initial sand plant is 440 v., 3 phase, 60 cycle. One main line switch, cuts off the current for the entire plant, while another oil switch cuts off everything but the water pump, which is kept alive for fire protection purposes.

Provided with Excellent Market and Railway Facilities

The plant is well situated with respect to markets and ships over the Peking Railway Terminal which makes delivery to any railroad in Peoria or Pekin. The company has access to ten railroads, eight of which are trunk lines.

The plant was designed by W. H. K. Bennett of Chicago and the Link-Belt Co. All the equipment in the screening plant, with the exception of the crusher is of Link-Belt manufacture. Ben F. Smith, of Pekin, Ill., was the erecting engineer.

The president of the Springfield-Pekin Gravel Co., whose main offices are located at Springfield, Ill., is John Sours. Mr. Sours, who is well past 70 years, has active charge of the operation of the plant. M. D. Schaff, is vice-president, D. H. O'Keefe, secretary-treasurer and J. E. McClanahan, superintendent.

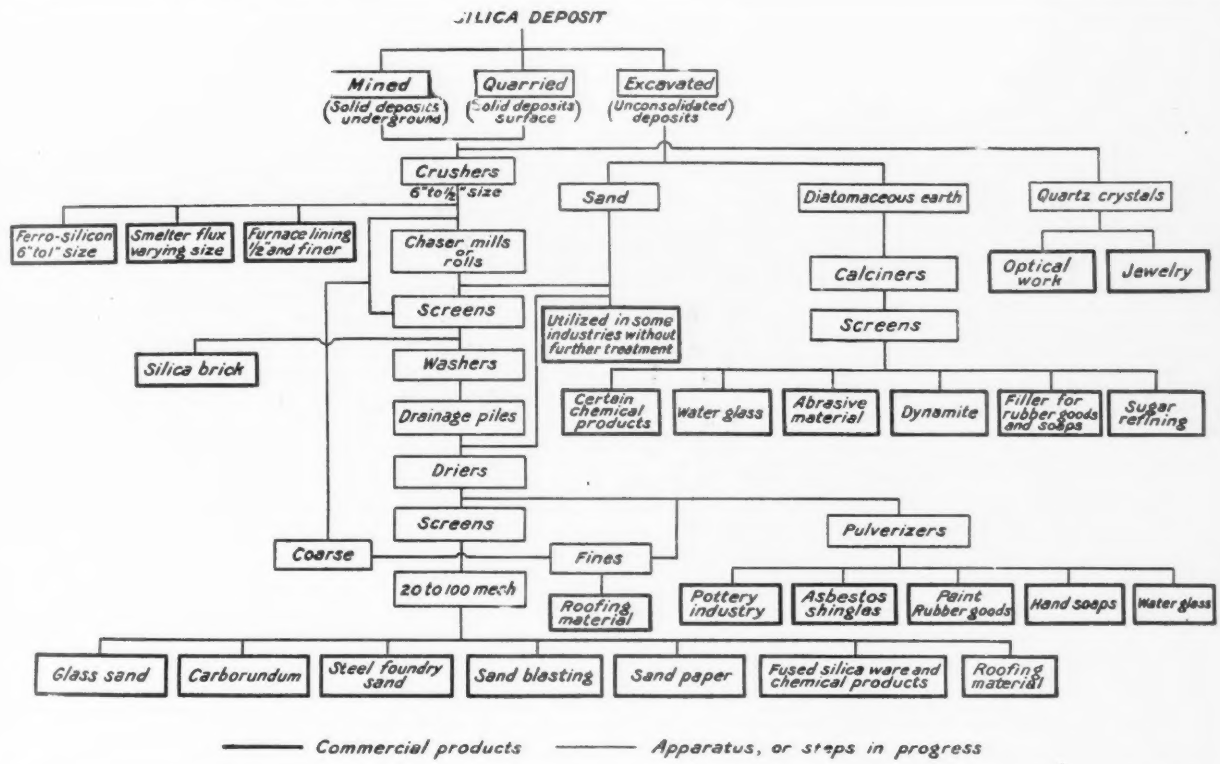


Plan and elevation of the very complete drainage system with a section through the drain

The Industrial Uses of Silica

This Commonest of Elements Plays a Great Part in Our Daily Lives and Supplies Many Useful Things

THE part that silica, the commonest of elements, plays in our industrial life is well shown in the diagram below, which is from "Silica in Canada," by L. Heber Cole, and published by the Canadian government.



The chart shows not only the uses of silica but the preparation required to make the various products

The greater part of the silica used is mined as silica sand. The uses of lump silica are practically confined to fluxing, making ferro-silica and furnace lining, for which purposes it is never broken below ½ in. A considerable part of the silica sand used is quarried as a friable sandstone, which crushes readily to sand. Even the unconsolidated sand deposits show some lumps of a similar material.

The flow sheet shows the preparation of the silica sand by crushing (where necessary) and screening, washing and drying. Practically all silica sand is sold dry. Once on the market it enters into such a number of diversified uses that they can hardly be catalogued here.

Glass is perhaps the most important use, but a very large amount is used as steel molding sand. A discussion of the qualities of a good glass sand will be found in the last issue of ROCK PRODUCTS in "Geology of Glass Sands." The principle requisites seem to be, high silica content (98 to 99 per cent), very low iron, less than 0.20 per cent Fe_2O_3 and the right texture, or grain size, all passing 14-mesh and very little passing 100-mesh

Steel molding sand needs to be graded according to the size of the castings which are to be made, heavy castings requiring a coarser and more uniform grain in order to secure permeability and the ready escape of gasses. Slight physical differences which affect the bonding are also important.

Sand-blasting sands must be hard and, in this country at least, the preference is for rounded grains as against the sharp angular grains. It is separated into several sizes, four in some districts five in others, for the market, the coarsest size lying between ¼-in. and 6-mesh. Some ocean beach sands are used for sand blasting on the Atlantic coast.

Finely pulverized silica, usually made by grinding the sand in either wet or dry tube mills plays a great part in our daily life. Table ware, sanitary ware, electrical porcelain, chemical porcelain and floor and wall tiles are a few of the things made from it in combination with clay and feldspar. Paint filler of silica is a standard pigment and is important to make paint "work" on green wood and to increase durability. Then there are a host of minor uses such as making water glass, dusting molds in foundries, making roofing papers and asbestos shingles, "sand" soap, polishing, etc., to which ground silica is applied.

To be considered a silica sand, sand should contain at least 95 per cent SiO_2. Most silica sands will contain 98 to 99 per cent SiO_2 with Al_2O_3 from 1 to 0.25 per cent and traces of other substances. Silica is the most abundant mineral in the world's crust, but a very large part of it is combined with other rock-making minerals.

An example of a very pure washed silica sand contained:

SiO_2—99.31%
Fe_2O_3— 0.09%
Al_2O_3— 0.26%
CaO— 0.17%
MgO— 0.09%
and lost 0.12% on ignition

A not inconsiderable amount of silica sand has been brought into this country from European countries, especially Belgium, by ships returning in ballast.

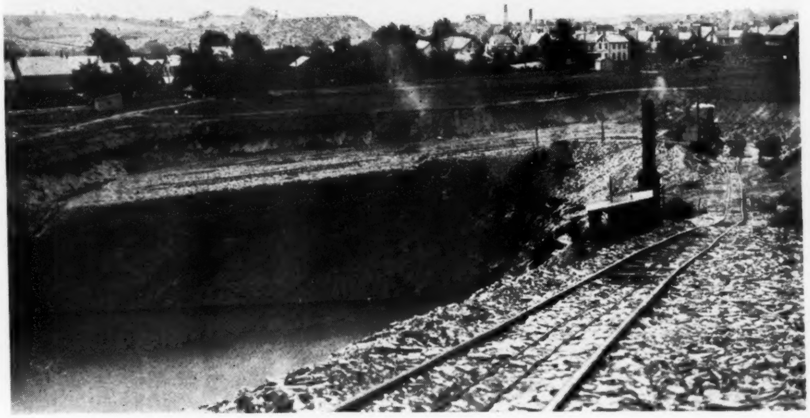
A Sign of "Good Times" Ahead for the Slate Industry

Extensive Preparations to Make an Abandoned Quarry Ready for Further Production—Pumping 200 Feet of Water to Reach Old Workings—Unusual Method of Stripping

By A. B. Sanger

ALTHOUGH the Jackson Bangor Slate Company, Pen Argyl, Pa., already has three quarries working, it is preparing three others for further production. The largest pit was abandoned several years ago but is now being "stripped for action." The other two quarries mentioned above are about ready, as the necessary preparations were few.

This quarry presented not a few problems and the expense was expected to be large, so it is only natural to assume that the company had abundant faith in the future of the slate industry, as it was willing to spend $50,000 or more to rehabilitate an old pit.



The water, 200 ft. deep, covers good slate. It is being pumped out. Stripping operation is shown at the right

Large Area Already Stripped

As will be seen by the pictures, quite an area (300x100 ft.) has already been stripped to a depth of about 15 ft.; fully 6 ft. more must be removed at the shallowest part before good slate rock can be reached. Stripping is being done by steam shovel, which is the most economical method, owing to the nature of the deposit. The bulk of the overburden is weathered shale which breaks up readily with the shovel, but which by its very nature precludes the use of hydraulicking methods, notwithstanding that other conditions, such as water supply, grade, distance, dumping ground, etc., would be well adapted to such a method.

Instead of stripping the next bench from the upper to the lower and following with the track, this usual method is to be reversed. The shovel makes an initial cut for the track from the upper to the lower end and then digs its way back. When that has been done it returns to the lower end without stripping and starts in again; shifting the track over to accommodate the shovel. This has been so planned because of the way the shale splits; the broken pieces falling back into rather than away from the shovel and because the stroke of the shovel is somewhat in line with the cleavage.

Group of slate workers employed at the Jackson Bangor quarries

Disposing of Overburden

The disposition of overburden is a serious enough matter in any quarry, but in a slate plant it is especially a problem. The waste slate itself uses up many acres of valuable ground and it is not desirable to add overburden to it unless this is absolutely necessary. This company has got around the difficulty by laying a track up the side of a waste pile and dumping the overburden into the upper end of the same quarry

Left, a close-up of strippging operations, showing the nature of the overburden to be removed. Right, abandoned upper end of quarry, where the overburden is dumped. In the right foreground good slate may be seen

which is being extended by the stripping described in this article. This upper end has been worked out and will never be worked again, so the disposal of waste in this case was simple.

Considerable further preparation beside stripping is required before the quarry can be operated. New towers, cable ways, hoists and a boiler plant must be installed. Plans call for the installation of this equipment in the fall so that operations can be started next spring.

As the lower end of the quarry already worked has good slate in it, the company plans to pump out the water as the new quarry floor is lowered. There is about 200 ft. of water in the pit, which means that a large sum must be expended for pumping alone before the quarry can be put in shape to operate.

The interesting feature about this proposition is more in its relation to the slate industry as a whole rather than in its actual mechanical operation. Stripping problems may be encountered anywhere and usually solved in a satisfactory manner just the same as in this case. But, to go to this expenditure is a sign that the company believe that the market for slate must be going to increase year after year.

Good Prospects for Slate

Mr. N. M. Hale, the President, is in a position to know the industry thoroughly, both the producing and marketing end, as he is also president of the two selling organizations, The Structural Slate Company and The Natural Slate Blackboard Company. He is also very active in The National Slate Association, an organization which is doing excellent work in stimulating consumer interest in slate. With his finger on the pulse, Mr. Hale undoubtedly feels that "good times" are ahead and is willing to back his judgment by spending good money in development work for the future.

This shows how the ground is left by the stripping operation

How Good Roads Pay

By Geo. Hogarth

Chief Engineer, Department of Public Works of Ontario

There is a cash value to good roads in the saving of wear and tear on vehicles that can not be too strongly emphasized. The benefits of good roads are shown by the reduced cost of maintenance and longer life of automobiles run over good roads on one hand and bad roads on the other. One type of car with which you are all acquainted and of which the department has a number has been used by us since 1917 when our highway system was first assumed. The cars bought in 1917 and 1918 were run over the roads in the condition the highways were in when taken over and in some cases the cars were practically wrecked in a season's wear. When turning in such cars and renewing them we were allowed a sum of money which represented an average depreciation exclusive of repairs of $240 per car per year.

In 1923 we turned in a number of cars for replacement and the actual depreciation was $125 per car per year. This is a saving in depreciation alone of $115 per car per year. With 272,000 cars and trucks in Ontario, many of which are more expensive than the car above referred to and half of which are owned outside the cities, there would be a saving of $15,500,000 per year on depreciation on cars and trucks owned outside the cities and using the low value of $115 depreciation per car per year.—Roads and Streets.—*The Constructor.*

Relative Mileage of Federal Aid Roads

THE relative mileage of the various types of road being built in this country is indicated by figures given by the Bureau of Public Roads of the United States Department of Agriculture. These figures apply only to federal-aid roads, but since they represent 25,000 miles of road now in use and include roads built in every state, they may be taken as fairly representative of the character of the main highways.

	Per cent
Gravel	39.1
Graded and drained	20.6
Cement concrete	18.3
Sand clay	10.8
Bituminous macadam	4.0
Bituminous concrete	3.1
Water-bound macadam	2.7
Brick	1.4

Complete figures covering all roads constructed and now in use would undoubtedly show somewhat higher percentages of the lower types of road.

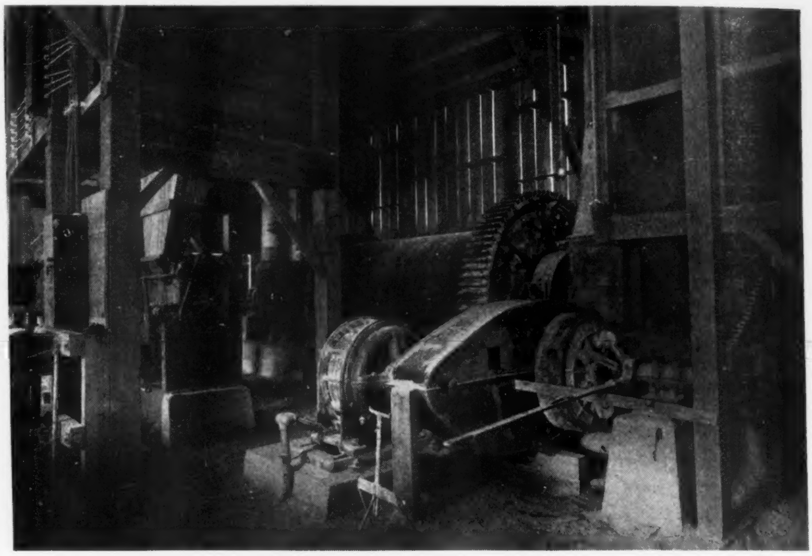
Pulverizing Dry Limestone by a New Process

E. J. Lavino & Company's Plant at Paoli, Pa., Uses Air-Swept Tube Mills for Pulverizing Limestone for Agricultural Purposes, Asphalt Filler, Etc.

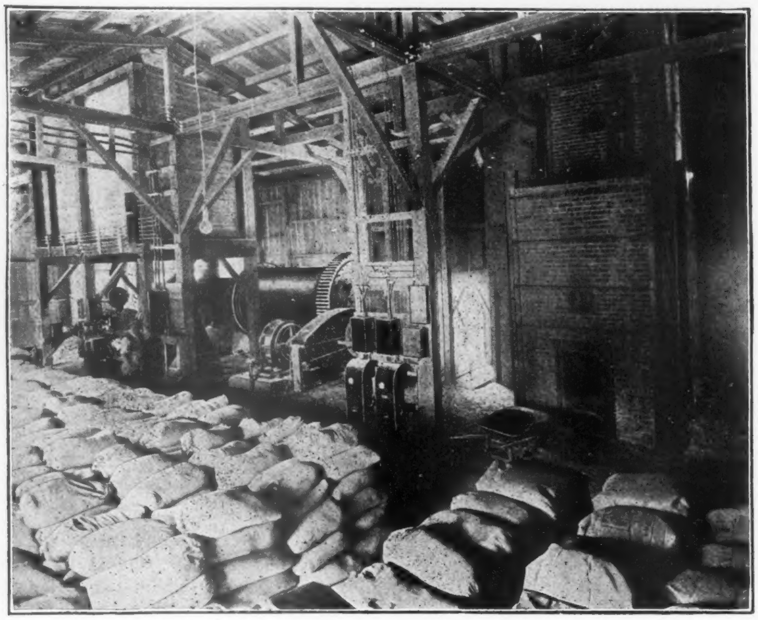
LIMESTONE for agricultural purposes, as well as for asphalt filler, belt dusting, roofing paper, etc., is prepared in numerous ways, pulverizing machinery of every description being used to manufacture these products. But what is undoubtedly the latest method has been installed in the form of an air-swept tube mill at the plant of E. J. Lavino and Co. at Paoli, Pa.

The pulverizing plant, as a whole, has a very compact layout and a simple flow sheet. Stone from the quarry is reduced to proper size in a gyratory crusher and when needed for pulverizing purposes it is deposited on an inclined belt conveyor feeding a storage bin adjacent to a 4x4x50-ft. Kennedy tower dryer.

A belt and bucket elevator, of 50-ft. centers, recovers the material from the bin and feeds it to the tower dryer, the size being ¾-in. and finer. The dryer has a dutch oven furnace, and the moisture is taken out of the limestone by heated air as the limestone drops from one baffle to the other in the dryer. When the stone reaches the discharge point it is practically free from moisture and is picked up by a chain bucket elevator, of 13-ft. centers, which discharges the dried stone to a 13-ton hopper ahead of the air swept tube mill. The main elevator is driven by a 10-hp. motor, to which is also belted a 25-in. fan on the tower dryer for creating proper draft conditions. The small chain elevator is driven by a 5-hp. motor.



There is no discharge from the tube mill except by the blast of air that sweeps through it from the fan and air boxes by which the discharge is regulated



Air swept tube mill at left and furnace of the tower dryer at right. This picture shows how compact and simple a design is possible with this pulverizing process

The dried stone in the hopper is taken out by a regulating disc feeder and fed into the 6x12-ft. air-swept tube mill charged with the following amount of forged steel balls:

1 ton of 2-in.
1 ton of 3-in.
1 ton of 4-in.
5 tons of 1-in.

The air-swept tube mill is an innovation in the reduction of materials in that it has no discharge lifters and no means of extracting the materials except by the velocity of air through the mill.

The mill has air boxes at both feed and discharge ends. These boxes have valves on both sides so that the quantity of air delivered at the feed end and taken out at the discharge end may be varied to regulate the fineness of the discharged product. The

Exterior view of the plant. The tall structures house the tower dryer (left) and the cyclone collectors (right). In the center is the inclined conveyor that brings the crushed rock from the crusher house to the pulverizing plant

valves on the air box at the discharge end of the mill can be regulated so that the elevating power of a 60-in. fan, at this end of the mill, is maintained to lift the material through a system of cyclone collectors. The mill is driven by a 125-hp. motor through a 16-in. Morse chain drive; the fan by a 25-hp. variable speed motor direct-connected through a flexible coupling.

Cyclone Collectors

The pulverized material from the mill is swept through a 6-ft. and a 10-ft. cyclone collector, with a 4-ft. auxiliary collector, all in closed circuit with the mill. The air from the 10-ft. cyclone is returned to the feed end of the mill.

Power Consumed

A recent test made by the engineers of the plant, with the fan set at 650 r.p.m., showed the following analysis:

Capacity = 11.8 tons per hour.
Power consumed on fan = 12 hp.
Power consumed on mill = 120 hp.
Material from 6-in. cyclone—
84.5 per cent through 200-mesh
94.8 per cent through 150-mesh
99.2 per cent through 100-mesh

Material from large cyclone all went through 350-mesh.

The horsepower required was less than 12 hp. per ton of ground product.

The material from the cyclones is discharged to a 60-ton storage bin underneath which are two Bates two-sprout packers. As the material is sacked it is trucked away for shipment or into storage.

The tower dryer, air-swept tube mill, cyclone collectors and subsidiary machinery was manufactured by the Kennedy-Van Saun Mfg. & Eng. Corp., of New York,

Sectional elevation through end (left) and through the side (right). This shows the elevator and the tower dryer with the baffles that prevent the material from falling too rapidly through the heated air. The tube mill is swept by air from the fan shown at end of mill which takes out the finely pulverized material and carries it to the cyclone collectors

At the Lavino plant the pulverized material falls from the cyclone collectors to a storage bin and packers which put it into bags

N. Y., who also engineered the complete plant and conducted the tests shown above. The total horsepower required to the pulverizing plant is 175 hp. All motors are of General Electric Co.'s manufacture.

Picking Tube Mill Pebbles in California

ALONG the California coast you will find them at times—the pebble pickers. Especially after the high tides have receded, you can see them searching along the beach, stooping here and there to pick up a white flint pebble and drop it into the sack they carry, says *Cement Association Bulletin*. Pebble picking is their trade. It affords them a living, for there is a regular market for the hard, white flint stones, and the ocean is kind enough to distribute these along the beach at intervals.

Flint pebbles are in demand by the cement mills of the Far West for use in the grinding mills. After the raw material from which portland cement is made has been crushed it is placed in the tube mills for pulverizing. In these mills it is ground so fine that 85 per cent of it can pass through a sieve finer than silk. To produce this fineness the flint pebbles are called on.

From 12 to 15 tons of the pebbles, varying from the size of an egg to that of a baseball, are placed in the big tube mill, along with the crushed clay and limestone used in making cement. As the mill revolves, the hard pebbles climb partly up the side of the tube, drop down on the raw material mass, and slowly but surely grind it into a fine powder.

In most cement mills in other parts of the country steel balls are used. But in the Far West, the pebbles are still used, because their low cost makes it worth while. Small tube mills are charged with from 10 to 11 tons of balls, while the larger ones contain as high as 34 to 38 tons. There was a time when flint stones from France and Denmark were in demand, but the steel balls have destroyed this foreign trade.

In the Puget Sound region pebble picking was quite a business a few years ago, before steel balls came into general use. Here the pebble pickers gathered the white flint stones from the beaches, while they were constantly on the lookout for more valuable agates and moonstones. The pebbles used to sell for about $2 a gunnysack and were transported to market on large scows.

Failure of Concrete Roads from Dirty Aggregates

CONCRETE roads, like other concrete structures, have disintegrated because defective materials have been used. Projects have been constructed in spite of laboratory reports condemning the fine aggregate, and these projects have shown signs of disintegration within a comparatively short period after opening them to traffic. Dirty aggregates, especially those containing clay-covered particles, organic matter in the sand, fine aggregate which has too high a percentage of fine particles and clay, all have been used in concrete road construction, and all have resulted in poor concrete. Screenings for use as a fine aggregate are to be looked on with considerable suspicion and certainly when they are permitted their grading must be governed so as to insure a workable concrete which will not contain a high percentage of dust.

There is no excuse for poor concrete roads from any of the above causes. Unfortunately, however, careless or ignorant inspection coupled with studied neglect of laboratory warning has resulted in poor materials being used in a number of concrete roads in the past. The disintegrating effect of certain types of alkali, principally the sulphates of sodium, potassium and magnesium, are well established, and cases are on record in our Western districts in which alkali seems to have played a prominent part in causing rapid disintegration of certain concrete pavements. As the alkali must reach the pavement through capillary action, it would seem that where concrete pavements are to be laid on a soil highly charged with alkali salts there should be interposed between the concrete and the underlying soil a layer of material having low capillary action. Several inches of sand should be quite effective for this purpose.—*A. T. Goldbeck, U. S. Bureau of Public Roads, in Roads and Streets.*

A Correction

IN the article, "New Michigan Lime Plant Has Efficient Layout," published in ROCK PRODUCTS for September 8, the statement was made that the plant started operations with two kilns designed by Richard K. Meade. Concerning this Mr. Meade writes:

"We have never at any time furnished any kilns or design for a kiln for any man by the name of E. P. Smith, or, in fact, for any kilns which were to be built in Michigan. We do not know anything about these kilns. They do not represent any ideas of ours as to what equipment would be advisable for his plant. So far as we know every kiln which we have designed is in operation today practically along the same lines as originally laid out by us."

ROCK PRODUCTS regrets that it made such misstatement, but assures Mr. Meade that the information came from a source that was considered reliable.

Farmers Ground Limestone Co. Sued for Abandoning Plant

A DAMAGE suit growing out of an alleged sale of stock in the company has been entered in the Preble county Common Pleas Court by Ansel Toney, of Eaton, against the Farmers' Ground Limestone Co., whose principal place of business is averred to be in Richmond, Ind.

Toney sues for $215.33. He avers he was sold $200 worth of stock in the company representing 20 shares at $10 a share upon representation that the company would proceed to manufacture agricultural limestone at New Paris and that he would be supplied the material at a special discount of 50 cents on the ton, the discount to continue until it equalled the $200 paid for the stock. He claims he received $51.67 worth of material, $17.22 being discount, and that he did not pay the balance of $34.45.

Shortly after he bought the stock, Toney avers, the company ceased to manufacture limestone and virtually abandoned its plant. —*Centerville, Ohio, Advocate.*

Magnesium Oxy-Chloride Cements

Their Properties and Uses in the Construction Field

By Max Y. Seaton
Technical Director, National Kellastone Co.

IN 1867 a Frenchman, Sorel, after investigating the reaction between zinc oxide and strong solutions of zinc chloride, extended his studies to other metallic oxide-metallic chloride combinations. The behavior of magnesium oxide-magnesium chloride mixes was of particular interest, and he investigated their properties at some length. The magnesium oxy-chloride formed from such a mixture proved to have exceedingly valuable cementing powers. It is this material which is the basis of the present magnesium oxy-chloride or Sorel cement industry.*

Because of the ability of these oxy-chlorides to bind woody fibres into a firm compact mass, giving a structural material of unusual resilience and yet good hardness, Sorel cement was first used in the preparation of composition floors, for in this field it was soon seen to fill a need not met by any other structural material. Very early, too, an effort was made to use Sorel cements in the preparation of exterior wall coatings or stuccors, for the lime stuccos commonly in use at that time left much to be desired as regards both cost and structural properties. A little later the magnesium oxy-chlorides were used for the preparation of artificial building stone, artificial marble, tile and similar shapes.

Why Oxy-Chlorides Failed

Although a certain amount of success was obtained in most of the lines in which the oxy-chlorides were tried, yet numerous failures continued to occur, frequently from apparently inexplicable causes. It is fairly easy to see how such a condition came to exist. Oxy-chlorides were ordinarily used by artisans who, although possessing excellent mechanical ability, had no real knowledge of the behavior of cementing materials as a class and depended for the formulas of their mixes on empirical knowledge handed down by word of mouth from their fellow workmen. Even when a worker familiar with the principles which were fast being formulated for the preparation of lime or of portland cement mortars attempted work with oxy-chlorides, failure just as frequently followed, because of the attempt to apply these principles without modification to an oxy-chloride mix, which as a matter of fact requires fundamentally different treatment. It has only been within the past ten years that sound data on the characteristic behavior of oxy-chlorides have become available, that their seeming eccentricities have been explained and that rapid progress

*Presented at the Richmond meeting, Dec. 6, 1922, of the American Institute of Chemical Engineers.

Typical magnesite country and mine at Porterville, Calif.

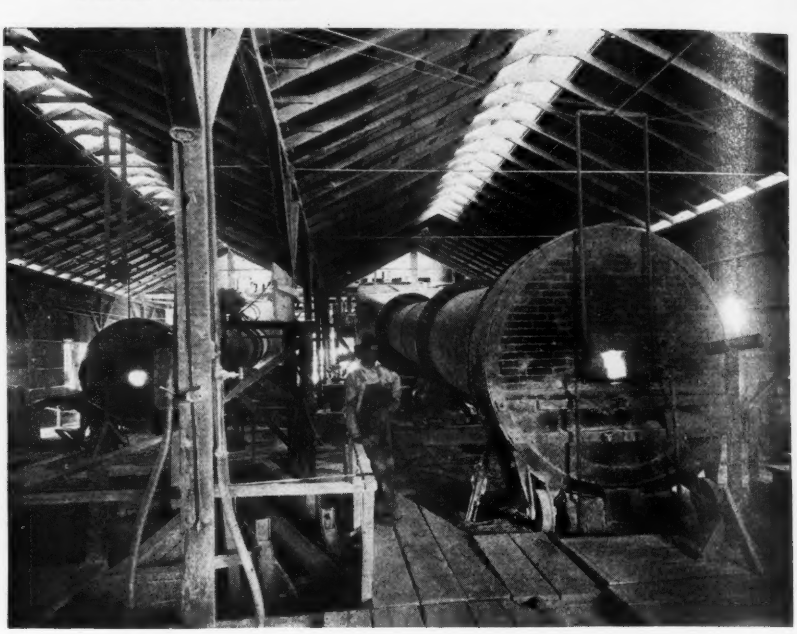
has been made in the development of the industry.

The Growth of the Industry

The growth of the industry to its present importance can be directly traced to the fact that magnesium oxy-chlorides have certain properties as a binding material not shared by any other cementing medium in common use. In proper mixes they attain high strength at a very early age, and this with free exposure to the air, letting surface evaporation go on as it will. This is obviously in marked distinction to the behavior of either portland cement, lime or gypsum products, all of which must be guarded from premature loss of water before complete hardening has occurred. The oxy-chlorides, too, sho wa volume change, due either to settling reactions or to temperature changes, lower than that exhibited by any other common structural material.

As has been previously noted, also, the oxy-chlorides are unique in their ability to bind woody or fibrous aggregates to a product of high strength, thus making possible the development of a mass of distinctive characteristics. In the present day use of oxy-chlorides it will be found that the fields invaded by these products are those which call for one or another of these properties indicated in higher degree than that exhibited by competitive products.

Although much time has passed since the discovery of the reaction between magnesium oxide and magnesium chloride solutions, the mechanism of the reaction and the constitution of the finished product is still the subject of considerable dispute. Space cannot be given to tracing the progress of the controversy on constitution or to the conflicting views of different observers. There is little question but that views of both sides, one of which contends for a definite chemical compound and the other for a colloidal or solid solution, are in part correct. Recent physical chemical research indicates that the binding materials existing in the average commercial product are in part made up of a definite chemical compound, 3 MgO $MgCl_2$ $10H_2O$, and in part of a solid solution of magnesium chloride in magnesium oxide or hydrate. The relative proportion of these two compounds may differ considerably in different cements. In all cases, however, the solid solution probably amounts to at least half of the total binder, and its properties strongly influence the characteristics of the cement.



The Sierra Magnesite Co.'s rotary furnaces for roasting magnesite

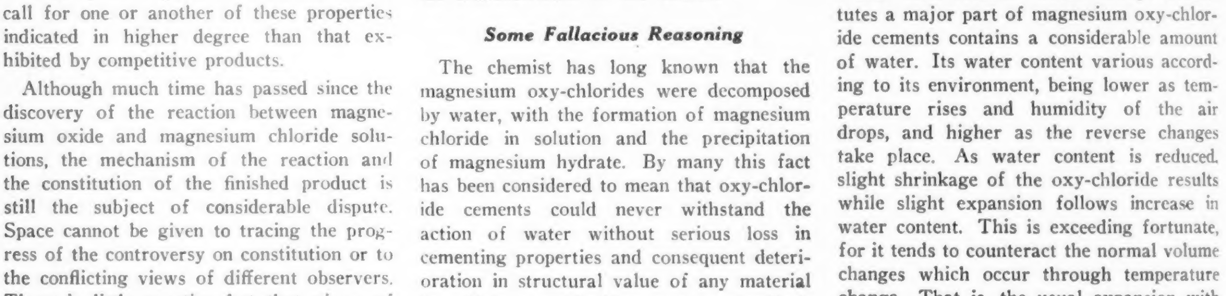
Some Fallacious Reasoning

The chemist has long known that the magnesium oxy-chlorides were decomposed by water, with the formation of magnesium chloride in solution and the precipitation of magnesium hydrate. By many this fact has been considered to mean that oxy-chloride cements could never withstand the action of water without serious loss in cementing properties and consequent deterioration in structural value of any material in which oxy-chlorides were used. Such reasoning is fallacious. Certain forms of magnesium hydrate closely resemble the natural mineral brucite, which is magnesium hydroxide, in properties, having high strength and excellent binding power. Fortunately, it is to these forms of hydrate that oxy-chlorides revert when such oxy-chlorides are of proper constitution and are weathered or wet in normal fashion. The recollection that the calcium hydrate in lime mortars is slowly transformed to calcium carbonate on aging should be sufficient to lay at rest the fear that a change in the composition of a cementing material need necessarily result in structural unsoundness.

The solid solution which always constitutes a major part of magnesium oxy-chloride cements contains a considerable amount of water. Its water content various according to its environment, being lower as temperature rises and humidity of the air drops, and higher as the reverse changes take place. As water content is reduced slight shrinkage of the oxy-chloride results while slight expansion follows increase in water content. This is exceeding fortunate, for it tends to counteract the normal volume changes which occur through temperature change. That is, the usual expansion with rise in temperature is, with the oxy-chlorides, counteracted, at least in part, by the shrinkage caused through loss in water of the basic binding material. It is particularly for this reason that the oxy-chlorides have the name of being remarkably free from expansion or contraction movements.

Raw Materials—Magnesium Oxide

Of the raw materials employed in the oxy-chloride cement industry, magnesium oxide stands first in importance. In Sorel's time magnesium oxides prepared from magnesium-carrying natural brines were em-



Curves indicating the behavior of oxy-chloride cement

ployed. This type of material is used but very infrequently in the oxy-chloride industry today, although it holds some possibilities for the future where special oxy-chloride cements are in question. Essentially all of the magnesium oxide used by the industry at present is obtained through the calcination of natural magnesium carbonate or magnesite, and appear on the market under the name of plastic calcined magnesite.

There are large deposits of magnesite in Greece and Austria, and it was from these sources that the expanding oxy-chloride industry on the European continent obtained its magnesium oxide supply. In fact, up to 1914, all but a very small fraction of the magnesium oxide used by the industry in the United States was obtained from these same sources. The war abruptly closed this source of supply, and it became necessary to develop magnesium oxide production in this country.

Beginning of the Industry in the United States

In 1914, the oxy-chloride industry was by no means as strong as it is today, and it is possible that it might have failed in its attempt to secure domestic production but for the emergency which sutting off of magnesite imports caused in the steel industry. Another type of magnesium oxide, commercially designed as refractory or dead burned magnesite, is widely used for lining basic open hearth furnaces, and the steel industry consumed far more calcined magnesite than was required by the infant oxy-chloride industry.

It was, first of all, the demands for magnesite for steel making which led to the rapid development of the magnesite deposits of California, and later to the exploitation of the Washington deposits. From these same sources plastic calcined magnesite, sometimes of questionable grade, began to reach the market. Later, as demand for refractory magnesite was reduced and importation again established, our domestic deposits were developed into producers of plastic calcined magnesite alone, little or no dead burned magnesite having been produced in this country for some two years past.

Magnesite occurs in veins or nodules in serpentine rock in widely separated districts in California, and associated with dolomitic deposits in northeastern Washington. The Washington deposits are high in iron and particularly adapted to the production of refractory material. California deposits are in many instancse almost iron-free, and burn to a product of such color that it can be employed in all branches of the oxy-chloride cement industry.

Specifications

Consumers of plastic calcined magnesite throughout the early development of the industry experienced grave difficulty in purchasing a product of satisfactory cement making properties. Plastic calcined magnesite was sold wholly on analytical specifications, the content of magnesium oxide, of ignition loss and of lime ordinarily being kept within moderately close limits. It developed that magnesium oxides of identical chemical analysis did not necessarily have comparable cement making value. At the joint instigation of the world's largest oxy-chloride producer and of the largest magnesium chloride producer in the United States investigations were undertaken which ended in showing the causes for the discrepancies previously noted, and for the first time establishing the industry on a substantial basis.

Laboratory Investigations

The gypsum and the portland cement industries have definitely established that the physical character and cement making value of their product cannot be specified in terms of chemical analysis. The lime industry has recently found the same facts to hold true for its particular field. A parallel case exists in plastic calcined magnesite. Laboratory investigators have long known that the reactivity of magnesium oxide was largely a function of the time temperature history of its calcination. At one extreme stands the active oxide first formed when carbon dioxide is just barely removed from the natural carbonate, while at the other extreme artificial periclase is found. This is still magnesium oxide, but shows no ability to react with magnesium chloride solutions or to become hydrated in contact with water. Neither of these products is satisfactory when used in the preparation of oxy-chloride or Sorel cements.

The material desired lies somewhere between these two extremes. Unfortunately, there are as yet no methods which will *rapidly* identify the particular oxide which the oxy-chloride industry needs. Recourse must be had to the preparation of oxy-chloride cements and the examination of their physical properties. In other words, physical tests have practically wholly replaced the chemical tests once relied on, and it is through such physical tests that all production of magnesite should be guided.

Production

Formerly all plastic calcined magnesite was prepared in stack or upright kilns of the type of the familiar vertical lime kiln, and such kilns still persist in some California operations, although their product can never approach in quality the material obtained from other types of furnaces. If a magnesium oxide of high quality is to be prepared, time and temperature of calcination must be held within narrow limits. This is obviously impossible in the burning of lump ore in a stack kiln, where to insure heat penetration and decarbonization to the center of the lump so much heat must be supplied that the outer material is seriously over-burned.

For production of high quality material the ore must be sized within quite narrow limits, and a kiln or furnace adapted for burning such fine ore employed. Up to this time, because of the temperature involved, the rotary kiln only has been in active use. The Wedge or Herresoff furnace may, perhaps, find a field in the treatment of the higher iron ores, which calcine at a low temperature, but it is doubtful whether they will withstand the temperatures involved in the treatment of the purer ores, which must be heated to approximately 1100 deg. C.

Selective Mining Necessary

In mining operations care must be taken to hold the analysis of the ore delivered to a calcining plant within quite narrow limits. This is the principal place in the magnesite calcining industry where chemical analysis is of vital importance. As calcium carbonate is fairly completely decomposed at the calcining temperatures employed, and as the resulting calcium oxide is exceedingly injurious to the oxy-chloride reaction,[1] lime content must be held at a low figure. Then, too, small amounts of certain substances, notably iron, and to a lesser extent alumina and silica, influence catalytically the reactions which occur during magnesite calcining. If they are present in quantity, calcining temperatures must be lowered materially to avoid over-burning. These impurities are not injurious in the sense that lime is, but ore containing them must be kept separate from ore containing no such material and treated in individual fashion in order to yield a satisfactory product.

No particular comment is called for on the general operation of mining or of crushing the ore before calcination. In practice it is found that half-inch sizing is essential if the appearance of either over-burned or under-burned material in the finished product is to be avoided. Kiln practice, however, is essentially different from that common in either the cement or the lime industries, although it is conceivable that the lime industry will some day employ the methods used in the preparation of calcined magnesite.

Kiln Temperature Carefully Regulated

In the operation of a rotary kiln for magnesite production not only must the maximum temperature in the kiln be carefully regulated, but a temperature closely approaching the maximum must be maintained over a zone of considerable length. In normal practice the carbon dioxide is expelled from the magnesite at a temperature much below that necessary for the development of the particular type of magnesium oxide which is desired. Gas is fairly well liberated, in other words, before the ore enters the zone in the kiln in which definite temperature is maintained. It is the length of this zone, its temperature and the rate of passage of magnesite down the kiln which determine the character of the calcined product.

Space is too limited to discuss here the

[1]See in this connection, Seaton, Hill and Stewart, Chem. Met. Eng., Vol. 25, Page 270.

special features of burner design and of flame control which are necessary to obtain the necessary kiln conditions, or of the methods of pyrometry required to follow and control them. It is sufficient to say that the major problems in connection with the operation have been solved and that the quality of magnesite produced in a rotary kiln is consistently higher than that of similar material produced in any other type of furnace operating commercially.

Must Be Ground Finer Than Portland Cement

The calcined magnesite must be ground to a product somewhat finer than ordinary portland cement. For this grinding the use of ball or tube mills is not permissible, because of the packing of the material on the sides of such a mill. The ring roll mill using air separation or the burrstone mill give excellent product. For this particular grinding problem the old-fashioned burr mill, which has fallen into disrepute in many industries, is particularly adapted and gives a material difficult to equal by any other type of mill.

The finished plastic calcined magnesite is a fine powder, about 85 per cent of which passes a 200-mesh screen. It varies in color from white through creams to dark browns or even chocolates. The darker colored product may have intrinsically the same cement making properties as the lighter materials, giving only a cement of darker color, and consequently limited to use to those cases where color in the finished product is no object. The cream colored magnesite may give even a whiter cement than the pure white magnesite.

Physical Properties Most Important

The quality of plastic calcined magnesite is now determined by all progressive operators strictly through determination of physical properties of the cement which it gives when mixed with magnesium chloride and suitable aggregates. Chemical analysis is still made, but largely as a matter of interest, for its bearing on the cement making properties of the product is very slight.

Although the domestic reserves of magnesite are sufficient to supply the industry for many years to come, it has been recognized that the growing demands of the industry will eventually deplete these deposits, and another source of magnesium oxide may be required. The most promising possibility lies in the extensive and widespread dolomite deposits of the country. Several writers[1] have indicated methods for making such dolomites available for the oxy-chloride industry. These methods involve either the burning of the dolomites at a low temperature in the attempt to prevent the decomposition of calcium carbonate, the leaching out of the lime from a burned dolomite with water, or the burning of a dolomite in an atmosphere high in carbon dioxide to repress the dissociation of the calcium carbonate. All of these methods have been tried in the laboratory and even on a small plant scale. The success of any or all of them in commercial practice is as yet problematical.

Raw Materials—Magnesium Chloride

Magnesium chloride is also an essential raw material for the industry. The potash deposits in the Strassfort region in Germany contain, of course, enormous quantities of magnesium chloride, which in more or less impure form is a waste product from potash plants. German magnesium chloride was for many years the standard of the industry in the United States, but particularly since the war domestic production has taken the place of first importance.

Two main sources supply all domestic magnesium chloride. One is the bitterns remaining after evaporation of sea water or of the brines from the Salduro marshes in the Great Salt Lake district. These bitterns are concentrated by solar evaporation, and an impure magnesium chloride solution containing also magnesium sulphate and sodium and potassium salts is obtained. This is further concentrated until the majority of the sodium and potassium salts and all but 3 or 4 per cent of the sulphates are removed. The material is finally marketed either as concentrated solution, in the form of loose crystals wet with mother liquor, or as fused solid. The Salt Lake district produces magnesium chloride only in connection with potash production, and as the potash plants there have been inoperative for some time past the district has ceased to be a magnesium chloride producer. At least four different operators on the Pacific Coast, however, send liquid or crystal magnesium chloride to the Western market.

From Salt Brines of Michigan

The most important domestic source of magnesium chloride is found in the salt brines of Michigan, which are worked primarily for bromine. These brines, contain also large quantities of calcium chloride, so that a simple separation of magnesium chloride by evaporation is not possible. Methods have been developed, however, for making the chemical separation from calcium within reasonable cost limits and so completely that the magnesium chloride produced ranks higher in purity than that obtainable from any other source. It appears on the market as fused solid or as flake or granular material, which latter is a distinct advantage from the standpoint of handling in the field. Quality of magnesium chloride can be definitely specified through specification of limits of impurities and of content of anhydrous magnesium chloride. A chemical analysis gives all the information desired.

In actual preparation of oxy-chloride cements a more or less dilute solution of magnesium chloride is employed. Strength of this solution is observed by determination of its specific gravity with a hydrometer, the Beaumé scale being universally employed. The preparation of this solution is left either in the hands of the worker handling the finished cement or in the hands of a supplier who furnishes it to the worker in liquid form adjusted to correct strength.

Addition of Aggregates

The remaining raw materials of interest to the industry may be classed under the general head of aggregates, and require very close attention by operators producing oxy-chloride cements. For a number of reasons the practice of assembling mixes at the point where they are to be applied—that is, adding sand and other aggregates to the magnesium oxide in the field—is not permissible. In the first place, only dry aggregates can be used, as the oxy-choride cements are very sensitive to variation in the strength of magnesium chloride employed in their preparation. If wet aggregates are used it is impossible to make proper adjustment for the varying amount of water thus introduced. Furthermore, a special knowledge is required for the choice of satisfactory aggregates.

Not only are more materials needed than are employed in concrete or gypsum plaster practice, where sand or sand and stone only are required, but the requirements for a satisfactory sand are quite different from those which hold in the preparation of high quality concrete. If sand only were needed in oxy-chloride cements, education or the insistence on special screening methods might solve the difficulty. All commercial products, however, contain a fine aggregate, such as silex or marbledust, and almost invariably a fibrous material such as asbestos.

Special Sand Needed

These materials, of standardized quality, are not available locally at the points where such cements are used. An even more vital factor in eliminating the possibility of field-prepared mixes is the fact that the principles of oxy-choride mix formulation are perhaps more complicated than those which hold for concretes. Mix balance is not improved by adding more magnesite as a factor of safety to take care of inferior aggregates, as can be done with portland cement in concrete work. Instead, the quality of an oxy-chloride mix is deteriorated if either too much or too little magnesium oxide is employed, and for best results the quantity of oxide used must be carefully regulated to the characteristics of the other materials used in the mix. For this reason factory prepared mixes are the standards in the oxy-chloride industry, and despite the disadvantages of such mixes in somewhat higher cost for transportation there is little liklihood of the use of field prepared mixes gaining in favor.

Use for Fine Sand

Little further comment is required on the various classes of aggregates employed. The

[1]Clark, British Pat. No. 1720 of 1881. Schurecht, Jour. Am. Ceramic Soc., Vol. 4, p. 558. Bole and Shaw, Jour. Am. Ceramic Soc., Vol. 5, p. 817.

sands used must be clean and free from loam, as is the case in concrete practice, but they should preferably be decidedly finer than a good concrete sand. The fine aggregate must be neither too fine nor too coarse, a material largely passing a 100-mesh screen but showing not over 65 per cent passing a 200-mesh being preferable. It may be either ground silica, known commercially as silex, or ground limestone or marble, provided this latter rock is hard, so that the individual particles of fine aggregate prepared from it show good strength. The fibrous materials which are almost invariably used may be either a short fibered asbestos, or wood sawdusts or flours of carefully regulated properties. In special cases other materials are also employed in oxy-chloride mixes, such as clays, to give greater plasticity and ease of working under the trowel; talcs, also for their trowelling effect; or colors, particularly in the various composition floors which employ oxy-chlorides as a binder.

Thin Glue Joint Principle

The most fundamental principle involved in the formulation of suitable oxy-chloride mixes may be described as the "thin glue joint" principle. It is common knowledge that in gluing two pieces of wood best mechanical properties are obtained when the glue film interposed between the two wood surfaces is of minimum thickness. Exactly the same principle holds for oxy-chloride mixes. The magnesium oxide-magnesium chloride mix which eventually gives an oxy-chloride of some indefinite composition should be considered as a mineral glue which will function to best advantage only when it is present as thin films between closely packed particles of aggregate.

Because the reaction between magnesium oxide and chloride is almost totally complete, without the surface reaction effect which exists between portland cement particles and water, it is necessary to supply fine aggregate to partially fill the voids between the coarser sand particles. If this is not done, so large a volume of oxy-chloride cement appears between sand grains that the thin glue joint principle is violated and weakness results. It is obvious that in following out this principle a mix of high density is unavoidably obtained.

Relation of Water to Solids

Oxy-chloride cements are finally used in by far the majority of cases by workmen of only ordinary skill, who in most instances handle the plastic cement with trowels or similar tools. It is obvious that such a worker will obtain best mechanical results if the mix he works with is easy to handle and can be applied with only normal effort. For this reason attention is given by oxy-chloride manufacturers to the production of high plasticity in their finished materials. This is usually done through the addition of asbestos or a related fibrous material. Fortunately, as will be later shown, such an addition is permissible here, and the change in ratio of liquid to solid resulting is not detrimental, as it is in portland cement practice.

Of vital importance too in the preparation of oxy-chloride cements is the question of the strength of the magnesium chloride solution employed. General experience has indicated that a solution of a gravity of 22 deg. Beaumé gives best results, and that if this strength is greatly departed from trouble will result.

The properties of oxy-chloride cements which are of interest from an engineering standpoint can, of course, only be investigated through the application of sound physical testing methods. A previous paper by the writer* has indicated some of the tests which are advantageous, and they need not be further elaborated on here. A distinctive feature of such test work is the employment of the cross bending test made on thin bars of the oxy-chloride cement, instead of the more common tensile strength of briquets or compression tests of cubes or cylinders. This procedure has been adopted because the conditions of aging of such flat test pieces parallel quite closely conditions existing in field practice, where the major uses of oxy-chloride products involve their placing in thin layers with free exposure to the air.

Attains Strength Rapidly

Oxy-chloride cements are particularly notable from an engineering standpoint because of their rapid attainment of high strengths. The rate at which such strength is attained and the subsequent behavior of the cement after maximum strength has been reached are dependent in part on mix constitution. Given a mix of proper balance, however, these factors are even more directly related to the properties of the magnesium oxide employed, which, as has been earlier indicated, may be varied by varying calcining conditions.

The point of control, testing and checking quality at Porterville, Calif., at the plant of the Sierra Magnesite Co.

Fig. 1, for example, shows the behavior of three different oxy-chloride cements, using in each case the standard testing mix, containing one part of calcined magnesite, two of silex, and five of standard sand, but varying the magnesite used. Curve A indicates the more or less familiar behavior of the oxy-chlorides in which some 80 per cent of final strength is developed in the first 25 hr. Curve B indicates an even more desirable type of cement for many purposes, the strength gain being progressive and final strength very high. An improperly burned magnesite, such as is sometimes encountered, may give the type of strength curve shown at C. The retrogression in strength indicated here has been reported as characteristic of oxy-chloride cements by many investigators. It does not occur, however, in a properly balanced mix when a normal magnesite is employed.

Effect of Water on the Cement

The question of the behavior of oxy-chlorides in contact with water has been previously mentioned. This again is a property which is largely influenced by the character of the magnesite employed. Fig. 2 gives results on three typical magnesites, using for the tests the methods described in the paper* earlier mentioned. The cement indicated at A, although it has very high initial strength, does not withstand water well and could not be considered of high quality. B is a marked improvement, but its wet strength is still too slow. C, although it does not have nearly as high strength before water treatment as the other two materials, yet is markedly superior to both of them in its ability to withstand dampness, for it shows but a moderate reduction in strength on wetting and after redrying

*A. S. T. M. Proceedings, Vol. 21, p. 1039.

*Seaton, A. S. T. M. Proc., Vol. 21, p. 1039.

has even a higher strength than it possessed before water treatment.

In this connection it should be noted that a fundamental feature of the ability of oxy-chlorides to withstand water is the fact that means must be provided to insure proper drainage of water from their surfaces, to prevent the collection of stagnant water on them or their immersion in small volume of water for lengthy periods. Under these latter conditions the water in which they are immersed or which lies on their surfaces soon becomes impregnated with magnesium chloride. Magnesium chloride solutions deteriorate oxy-chloride cements rapidly. When proper drainage is supplied or when the water volume is large or in continual circulation, chloride is removed just as in the former case, but it does not accumulate and act on the oxy-chloride, and no failure results. The behavior under normal exposure to water of a properly prepared oxy-chloride is indicated in Fig. 3, which shows the comparative change in strength and change in chloride percentage of a mix subject continuously to water spray.

Wet Mix Is Strong

Effect of strength of cloride and of change in mix composition have been shown in an earlier paper.† One other feature of the behavior of oxy-chloride cements may bear mention here; that is, their ability to give high strength even when exceedingly wet mixes are employed. The portland cement industry has been emphasizing strongly of late the fact that cement-water ratio is an all-important factor in determining concrete strength, and that if wet mixes are used strength is rapidly lowered. Although indications of the same effect are seen in the oxy-chlorides, the actual quantitative influence is much less. Comparative curves for a portland cement mortar and for an oxy-chloride cement are given in Fig. 4, which brings out in quite striking fashion the reason for the observed fact that oxy-chloride mortars can be prepared of quite a wide range of workability and still show some little change in final properties.

Uses of Oxy-Chloride Cement

Because of the distinctive ability of the oxy-chloride cements to form satisfactorily and to reach high strength with free exposure to the air, such products have been most widely used in those instances which require the application of a plastic coating in thin layers. The structural fields in which such conditions must be met are so broad that as yet little attempt has been made to introduce oxy-chlorides into other fields in which they may also be of value. With the stabilization of the industry and the availability of magnesite of uniform quality an assured fact, engineers are exhibiting more and more interest in this type of cementing materials, and are applying them to special problems.

The normal oxy-chloride or composition floors are of interest to the chemical engineer chiefly through their uses in buildings intended for light manufacturing, such as the preparation of fine chemicals, or as floors in laboratories. In such locations they are dustless, very resistant to abrasion, comparatively warm and soft under foot, and have the advantages of a hardwood floor with few of the disadvantages of such a material. The fact that they are considered standard by many architects specializing in hospital design is indication enough of their sanitary qualities, which for the uses indicated is also an important factor.

For Exterior Stuccos

The majority of current oxy-chloride practice is concerned with the preparation of exterior stuccos using these products as binders. Such stuccos have as yet played little if any part in factory construction. It should be realized, however, that because of their enormous strength and freedom from cracking, and because of their rapid aging, they offer marked possibilities for the construction of light buildings which must be erected with a maximum of speed and which are yet subject to such corrosive influences as would rapidly destroy sheet iron. Oxy-chloride stuccos can be applied either on wood or on zinc lath. When they are thus applied to ordinary wood studding, they make a building of high fire resistance, because of their non-combustible nature and also because of the fireproofing effect on all exposed wood of the magnesium chloride used.

Oxy-Chloride Plasters

The oxy-chloride interior coatings or plasters have recently found a distinct field in the treatment of the interior of buildings intended for the manufacture of fine chemicals, pharmaceuticals, etc., where absolute sanitation and cleanliness are essential. Such interior plasters, being waterproof and crack-free to an extent never obtainable with gypsum or lime products, lend themselves particularly well to circumstances where a plaster coating must meet heavy duty requirements.

Of great interest also is the use of oxy-chlorides for special mold work in the preparation of castings. Not only have they been employed for master patterns, but also for emergency work in which a pattern of a broken casting is desired. A thin oxy-chloride mix can be cast in a sand mold and will be firm enough to handle and true up inside of 24 hr., serving then as a pattern for a casting in metal. Oxy-chlorides have also been employed for cements in setting brick where great strength is required, for the lining of tanks to contain oils or fatty acids, for the construction of diaphragms, and many other miscellaneous uses.

A possible field for the use of oxy-chlorides in engineering practice, which has yet been but briefly investigated, is their employment in the construction of built up structural members to replace concrete where exceedingly light weight is desirable. Their strength is so high, being several times that of the strongest concrete obtainable, and the possibility for use with them of light aggregates is so attractive, that it is very likely that this field will eventually prove one of the main outlets for the products of the industry.

Lightness and Strength

It is obvious from the foregoing discussion that the oxy-chloride industry is yet in its infancy. Although the oxy-chloride reaction itself has been known for many years, the thorough study of the oxy-chloride which has resulted in a fairly complete knowledge of their behavior is a matter of the very recent past. They offer, however, a plastic material of unique properties which is certain to find a sphere of usefulness not only in the stucco and flooring field, in which they are already well established, but for many other structural purposes as well.

It is confidently expected that the next few years will show growth of the industry in many directions which cannot even be anticipated at this time. It is unnecessary to emphasize that the product is the result of chemical experimentation and the industry producing it essentially a creation of chemical enterprise.

†Seaton, Loc. cit.

A Correction

THE article, "New Michigan Lime Plant Has Efficient Layout," in ROCK PRODUCTS for September 8, page 25, stated, "A Northwest gasoline shovel loads both coal and limestone into ten-car trains of Western rocker-type dump cars, drawn to the foot of the kiln incline by a Plymouth gasoline locomotive." The locomotive used here is not a Plymouth. It is a No. F-25 four-ton Milwaukee gasoline locomotive.

Badly Run Air Compressors

IN a paper read before the South African Institution of Engineers, Mr. A. E. Simmons, said that an air compressor, installed without due consideration of the operating conditions of inlent and discharge pipes and run without periodical check on its performance, may be a source of considerable and unnecessary expense to its owners. It is not uncommon, he declared, for the total amount of lost work to be equivalent to a 10 per cent increase in power requirements as compared with the normal best performance. In some instances the losses have been considerably more than 10 per cent without the plant owners recognizing how serious was the loss.

Memphis Sand and Gravel Plant Slides Into Mississippi

THE Mississippi river opened its jaws Thursday night and swallowed the huge plant of the Central Sand and Gravel Co., situated 75 ft. from the Riverside park bluff.

Where the $150,000 plant stood Thursday was a gigantic crater Friday, 300 ft. from brink to brink. In the bottom of that chasm, dwarfed by the ragged, red walls, lay the mangled plant, twisted and rent.

Among a mass of twisted rails, bent like a ball of baling wire, and the remains of a trestle siding, were three freight cars. A locomotive reclined like a crushed animal under a concrete gravel bin, 30 ft. long, 8 ft. wide and 80 ft. deep.

If the thing had happened in the sunshine instead of by the light of the moon, a score of men might have disappeared with their place of work.

Twenty-five men are employed there regularly.

As it was, two, J. W. Crampton, night watchman at the plant, and his wife, who was talking with him in the company office, narrowly escaped being carried into the maw of the river.

L. T. McCourt, secretary, was first on the scene Friday morning. He made a definite estimate of loss at $100,000. He said the plant could be rebuilt and filling orders in from 60 to 90 days.

Fischer said the plant will be rebuilt on a site farther from the bluff.

Negligence saved the company's new $35,000 steel barge from being wrecked. When the workmen left the plant Thursday afternoon they left one of the mooring lines untied. Crampton tried to tie up the barge after it had swung out but he could not.

The Central Sand and Gravel Co. was organized two years ago, and the plant built new upon the site occupied by the old Portland Cement Co. W. W. Fischer is president; L. T. McCourt, secretary; C. C. Hawkins, vice-president, and W. N. Fry, treasurer.—*Memphis, Tenn., Press.*

California's Production of Rock Products

THE production of those substances in which the readers of ROCK PRODUCTS are especialy interested is given in the following abstract from the report of the state geologist, Lloyd L. Root:

Of the structural group: brick and tile increased in value from $5,570,875 to $7,994,991; miscellaneous stone (comprising crushed rock, sand and gravel, paving blocks) from $7,834,640 to $10,377,783; magnesite, lime, marble and onyx also increasing; cement, although increasing from 7,404-221 to 8,962,135 bbl. in output, decreased from $18,072,120 to $16,524,056 in value. Slate again joined the active list with a small yield.

In the "industrial" group there were a number of fluctuations, the more important increases being shown by mineral water, pottery clay, gypsum and pyrite; and decreases by diatomaceous earth and limestone. Two new items were added in 1922 to this list, not previously produced commercially in California, namely, shale oil and sillimanite.

The distribution of the 1922 output of California by substances is shown in the following tabulation:

Substance	Amount	Value
Asbestos	50 tons	$ 1,800
Barytes	3,370 tons	18,925
Bituminous rock	4,624 tons	13,570
Cement	8,962,135 bbl.	16,254,056
Dolomite	52,409 tons	114,911
Feldspar	4,587 tons	37,109
Fuller's earth	6,606 tons	48,756
Granite	....	676,643
Gypsum	47,084 tons	188,336
Lime	578,748 bbl.	671,747
Limestone	84,382 tons	282,181
Magnesite	55,637 tons	594,665
Marble	38,321 cu. ft.	127,792
Mineral paint	1,620 tons	13,277
Onyx	10,950 cu. ft.	3,320
Pumice and volcanic ash	613 tons	4,248
Silica (sand and quartz)	9,874 tons	31,016
Soapstone and talc	13,378 tons	197,186
Stone, miscellaneous*	....	10,377,783
Zinc	3,034,430 lb.	172,963
Unapportioned†	....	380,558

*Includes macadam, ballast, rubble, riprap, paving blocks, sand, gravel, and grinding-mill pebbles.
†Unapportioned — includes calcium chloride, graphite, diatomaceous earth, lithia, shale oil, sillimanite, and slate.

Prepared Roofing Simplified

AT a meeting held September 26, at the Department of Commerce, with representatives of the Division of Simplified Practice and the Chamber of Commerce of the United States, manufacturers, distributors and consumers of prepared roofing agreed to the following simplifications as being of benefit not only to the industry but also to the public at large:

1. To eliminate all grades or kinds of slate-surfaced and also stone-surfaced prepared roofing that do not measure up to the requirements of the "Class C Label" of the Underwriters' Laboratories.
2. To reduce the varieties of smooth surface roofing to seven lines or grades—weights and qualities being considered.

This Simplified Practice Recommendation is to become effective January 1, 1924, and is to hold for one year.

According to Wm. A. Durgin, chief of the Commerce Department's Division of Simplified Practice, this is another step in the general program fostered by Secretary Hoover for the elimination of waste in industry. "The proposed eliminations," he said, "were strongly supported by the American Institute of Architects, the National Retail Hardware Association, representing 21,000 retail hardware dealers throughout the United States; the National Retail Lumber Dealers' Association, the Southeastern Builders' Supply Association and the Prepared Roofing Association."

Prepared roofing is a product used all over the world, not only as a roofing material, but in cane fields and elsewhere for keeping weeds down and retaining moisture and warmth.

It is believed this program will bring many economies to the manufacturers, such as decreased idle stocks, less idle investment and ultimately lower production costs and benefit the distributors by stimulting turnover and increasing sales. Consumers will also benefit in due time through better quality, better prices and quicker service. Several other simplifications of building materials have been completed, including hollow building tile, cement brick, block and tile, drain tile, etc. All of these simplifications are contributing to the general effort to reduce the needless wastes in the building field, and thus forward the achievement of the ideal now so prominently before the public—"Better Homes at Lower Cost."

Safety Conditions in Stone Quarries

Safety conditions in the stone quarrying industry throughout the United States shows a slight improvement in 1922 over the preceding year, according to reports received from operating companies by the Department of the Interior through the Bureau of Mines. A tabulation of the operators' reports showed a fatality rate of 1.91 per thousand full-time workers as compared with a rate of 2.00 for the previous year, and an injury rate of 170.92 as compared with 174.54. This reduction in the accident rates, though slight, is particularly gratifying in view of a gain of more than 15 per cent in the volume of work done during the past year.

The Bureau of Mines figures show that in 1922 the quarry industry employed 79,081 men, of whom 48,527 worked in the pits and 30,554 worked at the crushers, rock-dressing plants, and at other outside plants. The men within the quarries averaged 248 workdays during the year and worked a total of 12,057,954 shifts, an increase of 11 per cent over the number of shifts worked in 1921; men employed at the outside plants averaged 285 days and worked 8,721,884 shifts, an increase of nearly 22 per cent. The average working time for both groups of men was 263 days and the total number of shifts worked was 20,779,838.

Accidents to men working inside the quarries resulted in 92 deaths and in the injury of 7,049 men, indicating a fatality rate of 2.29 and an injury rate of 175.38; men working at plants outside the quarries suffered 40 deaths and 4,790 non-fatal injuries, showing a fatality rate of 1.38 and an injury rate of 164.76 per thousand employes, based upon a standard year of 300 working days.

The increase in the number of shifts worked by all employes in 1922 was not confined to any single branch of the quarry industry, but was distributed among the seven classes of quarries—cement rock, granite, limestone, marble, sandstone, slate, and traprock—grouped by the Bureau of Mines for statistical purposes.

Many Unusual Exhibits at Mining Congress

Exhibitors Plentiful and Many New Types of Equipment Displayed —Resolution Passed to Hold Separate Coal and Metal Mining Conventions in the Future

REPRESENTATIVES of the greater number of companies exhibiting at the 26th annual convention and National Exposition of Mines and Mine Equipment of the American Mining Congress, held in Milwaukee, September 24 to 29, were well pleased with the show as a whole and practically everyone present declared it a success, notwithstanding the fact that the attendance of mining men was not up to some of the exhibitors' expectations. The open forum discussions of operating problems were alone worth going to hear and it goes without saying that operating men who attended profited by what they saw and heard and that exhibitors reaped an unestimable amount of good from their presence.

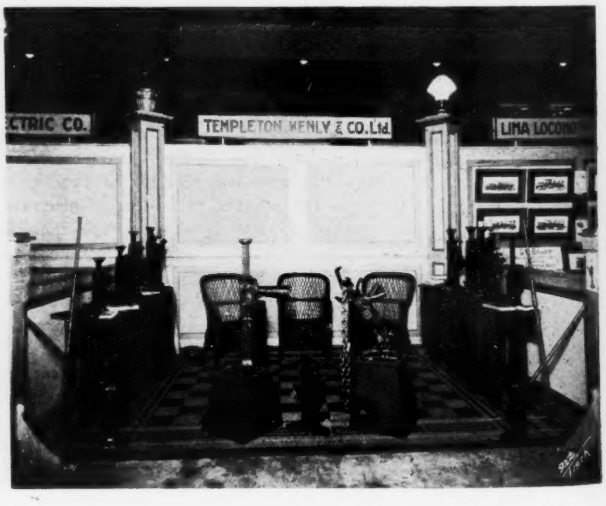
Approximately 50 per cent of the exhibits were of interest to men of the rock products industry as were, also, many of the open forum discussions of practical equipment problems. Rock drills, explosives, crushers, screens and hoisting equipment were discussed and many new operating ideas were released that will be of value to operators who attended upon their return to their plants. Such addresses as "Industrial Co-operation from the Public Standpoint," by Lawrence F. Abbott, Outlook Publishing Co.: "The Department of Labor and Its Relation to Business," by Edward J. Henning, assistant Secretary of Labor, were also of considerable interest to men of the non-metallic mineral industry.

The working model of a Sanderson-Cyclone drill attracted much notice

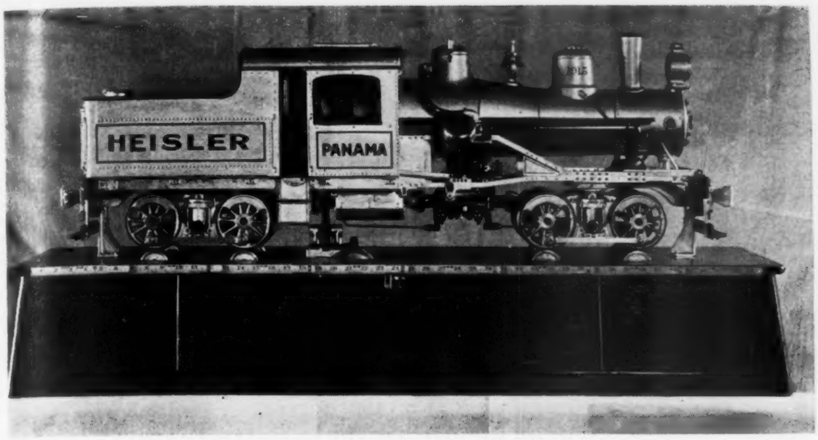
Separate Coal and Metal Conventions Favored by Manufacturers

At the exhibitors' luncheon held September 26, attended by about 130 representatives of exhibitors, a resolution was passed favoring separate coal and metal mining conventions. This move was taken because of the fact that the attendance of mining men has not always been up to the expectations of either group of manufacturers or to those serving both branches of the industry.

Both the coal and metal mining conventions will be under the auspices of the American Mining Congress, and will have the full support of the national organization. California is making a strong bid for the 1924 convention, and it is probable that it will be held in the West, covering the metal mining field. In view of this fact, the resolution provides for the holding of a convention and exposition in the coal mining district during the next



Left, the Magnetic Manufacturing Co.'s exhibit of high-duty magnetic pulleys. Right, Simplex jacks, made by Templeton Kenly & Co., in capacities from 3 to 15 tons



This beautiful little working miniature Heisler locomotive caught everyone's attention

18 months or two years. Succeeding conventions shall similarly alternate.

The board of directors of the Manufacturers Division was increased by the election of the following:

L. W. Shugg, of the General Electric Co.; Raymond Mancha, of the Mancha Storage Battery Locomotive Co.; C. L. Herbster, of the Hockensmith Car and Wheel Co., and M. P. Reynolds, of the Ludlow Saylor Co.

Exhibits Pertinent to Rock Products Industry

ALLIS-CHALMERS CO., Milwaukee, exhibited standard equipment, including tailing pumps, flotation machines and photographs of actual installations.

AMERICAN STEEL AND WIRE CO., Chicago, showed samples of all sizes of wire rope and cable.

ATLAS POWDER CO., Wilmington, Del., had on display its various sizes of blasting machines together with imitations of dynamite, powder, detonators and fuse.

BRODERICK & BASCOM ROPE CO., St. Louis, exhibited all sizes of wire rope and one of the company's latest models of aerial-tramway cage.

BUCYRUS CO., South Milwaukee, had on exhibition many interesting photographs of installations together with moving pictures showing various types of machines in action.

BETHLEHEM STEEL CO., Bethlehem, Pa., had some real switches and frogs set up together with photographs and illustrations.

CLIMAX ENGINEERING CO., Clinton, Iowa, had on display three of its latest engines, Models TU (5½x7), KU (5x6½) and R6 (direct-connected to 70-hp. synchronous motor to 2-kw. direct-current generator).

CHAIN BELT CO., Milwaukee, exhibited various types of "Rex" chain, gears, buckets, etc.

DINGS MAGNETIC SEPARATOR CO., Milwaukee, exhibited a 24x24-in. magnetic pulley and a Roche-type wet-belt concentrating machine.

DIAMOND MACHINE CO., Monongahela, Pa., had on exhibit a single-drum electric hoist and a Fort Wayne electric rock drill. The latter attracted considerable attention in demonstrations by drilling in a 2x3x4-ft. block of granite.

E. I. DU PONT DE NEMOURS & CO., Wilmington, Del., had on display dummy kegs and boxes of powder and dynamite, fuse, detonators, crimpers and blasting machines.

FLEXIBLE STEEL LACING CO., Chicago, showed samples of various sizes of metal belt lacings, also a new style electric light guard.

THE FALK CORPORATION, Milwaukee, exhibited one of its double-reduction-gear units, flexible couplings, gears and castings; also a splendid array of photographs.

GENERAL ELECTRIC CO., Schenectady, had on exhibit an Arc Welder Resistor, a mine-type storage-battery locomotive and a complete assortment of trolley and miscellaneous electrical equipment.

HEISLER LOCOMOTIVE WORKS, Erie, Pa., exhibited a complete working model, one-tenth actual size of class 55-8-38 geared locomotive.

HERCULES POWDER CO., Wilmington, Del., had two very attractive booths furnished with comfortable lounges and chairs with "William Jan" greatly in evidence. The company's paper, "The Highway Engineer," was printed daily during the convention and distributed among exhibitors and delegates.

HOAR SHOVEL CO., Duluth, Minn., had one of its "Baby Hoars" set up and demonstrations of its digging abilities were given at regular intervals.

IRONSIDES CO., Columbus, Ohio, exhibited its various grades of lubricants, including shields for gears, wire and fibre rope and cam plungers; also tormay oilers and industrial paints.

IRONTON ENGINE CO., Ironton, Ohio, had racks of photographs of all its models.

JEFFREY MANUFACTURING CO., Columbus, Ohio, showed its general line of material handling and mining equipment, featuring especially its mine-type locomotives, controllers, etc.

KEYSTONE LUBRICATING CO., Philadelphia, exhibited its various grades of grease, grease cups and manifold safety lubricators.

LIMA LOCOMOTIVE WORKS, Lima, Ohio, exhibited photographs of all models.

LAKE SUPERIOR LOADER CO., Duluth, Minn., exhibited its Model 107 Butler and its Model 12 Armstrong "Shuveloders." Demonstrations were given of both machines.

MANCHA STORAGE BATTERY LOCOMOTIVE CO., St. Louis, Mo., exhibited one of its "Electric Mules" and its new battery transfer rack, which, officials of the company claim, makes it possible to transfer a battery in three minutes.

MILWAUKEE LOCOMOTIVE MANUFACTURING CO., Milwaukee, exhibited two of its latest model locomotives—one of the mine type and the other for open work.

MANIERRE ENGINEERING AND MACHINERY CO., Milwaukee, exhibited in a novel way its boxcar loader by having two machines running, each discharging into the other.

MAGNETIC MANUFACTURING CO., Milwaukee, had on exhibit two high-duty magnetic pulleys—one a 24-in. diameter with 30-in. face and the other 30-in. in diameter with a 24-in. face. The company also exhibited a Type L separator, used in concentrating and refining.

MORSE CHAIN CO., Ithaca, N. Y., exhibited a chain drive equipped with a revolving slotted disc, thus affording spectators to see the workings of the roller joint.

MACWHYTE CO., Kenosha, Wis., had on display samples of wire rope, ranging in size from 1/16 to 3¼-in.

R. D. NUTTALL CO., Pittsburgh, exhibited various sizes of industrial helical gears and flexible couplings.

Left, Mancha Storage Battery Co.'s "Electric Mule" and battery transfer. Right, the Falk Corporation's display of double reduction gear units, couplings and castings

The Robins Conveying Belt Co. showed, not only idlers and other conveyor parts, but Cataract grizzlies and Perfex shaking screens

OXWELD ACETYLENE CO., New York, exhibited generators and a complete line of welding equipment.

OTTUMWA BOX CAR LOADER CO., Ottumwa, Iowa, had on display working models of practically all of its machines, including its push-type box car loader, portable loader, box car rocking cradle and a miniature grease handling system. The exhibit also included moving pictures showing the machines at actual work.

PAWLING & HARNISCHFEGER CO., Milwaukee, exhibited its latest model overhead trolley crane and cab, also a complete array of photographs of installations.

ROBINS CONVEYING BELT CO., New York, had on exhibit models of its Type S and Type C Cataract grizzlies and Perfex shaking screens, also idlers.

STREETER-ARNET WEIGHING AND RECORDING CO., Chicago, exhibited its electric automatic recording scale, using for the demonstration a section of track and mine car.

SMITH ENGINEERING CO., Milwaukee, had a working model of a complete crushing plant. The primary crusher (gyratory) was one-eighth the size of the company's standard No. 8 crusher. The plant was complete from crusher to car loading devices.

SANDERSON-CYCLONE DRILL CO., Orville, Ohio, attracted considerable attention with its working model. The machine is of walnut, brass and steel and is exactly like the regular blast-hole machines sold to quarries and open-pit mines.

THEW SHOVEL CO., Lorain, Ohio, surprised everybody with an entirely new type of loader. Due to the machine's weight (13½ tons) it could not be placed on the Auditorium floor, but was demonstrated at regular hours outside.

TEMPLETON, KENLY & CO., LTD., Chicago, exhibited all models of "Simplex" jacks, ranging in capacities from 3 to 15 tons.

WILLIAMSPORT WIRE ROPE CO., Chicago, had on exhibit all sizes of wire rope, clips, wooden and steel blocks, turnbuckles, shackles, etc.

WESTERN WHEELED SCRAPER CO., Aurora, exhibited a working model of its new 30-yd. air-dump car. The model is about 24 in. long by 8 in. high.

WORTHINGTON PUMP AND MACHINERY CORP., New York, exhibited a working model gyratory crusher. The machine is not only a model but is used in laboratories throughout the country. The company also exhibited a Class O, No. 2, Stillwell heater.

Although the attendance might have been improved, many visitors expressed their satisfaction at the high quality of the exhibits and the way they reflected the progress which has been made in the mining and allied industries.

Death of Charles H. Davis, of the Davis Slate & Manufacturing Co.

CHARLES H. DAVIS, known everywhere in the slate industry as president of the Davis Slate and Manufacturing Co., and a director of the National Slate Association, died at his residence in Chicago, September 15. He was 51 years of age. Members of the slate association who were in Chicago attended the funeral.

Mr. Davis came into the slate industry some nine years ago from the Westinghouse Co. He applied progressive ideas to the milling of electrical slate and he became one of the important manufacturers of electrical slate panels in this country and Canada, with several mills besides those in Chicago and Toronto. Formal resolutions were adopted, placed on minutes and sent to the family by the board of directors of the National Slate Association in session on the day of his funeral. A silent toast was given in memory of their lost member during the luncheon hour.

Mr. Davis was born in Baltimore, Md., January 25, 1872, where he graduated from the public school and attended John Hopkins University.

For several years he was connected with the Bausch & Lomb Optical Co. of Rochester, N. Y., after which he organized the Scientific Materials Co. of Pittsburgh, Pa. He later took charge of the Overhead Line Material Division of the Westinghouse Electric and Manufacturing Co. at East Pittsburgh, Pa.

Aggregates for Reinforced Concrete

THE following is abstracted from the *English Quarry Managers' Journal*, published at Carnarvon, North Wales, and is interesting as giving a British view of a subject most interesting to ROCK PRODUCTS' readers. Of course, "ballast" and "shingle" are British names for gravel; and we would say "cinders" instead of clinker in this country:

"In selecting an aggregate for reinforced concrete work, it is always best to forget the adaptability of such aggregates for plain concrete. The writer has elsewhere classified aggregates in the following order of merit:—

1. Graded Granite Chippings.
2. Clean Ballast or Shingle.
3. Limestone.
4. Broken Brick.
5. Slag.
6. Breeze or Clinker.

"Limestone as an aggregate is fairly satisfactory, provided it is free from dust, but unfortunately this rarely occurs. There is frequently a considerable quantity of clay present. Ballast, however, is usually a silica, cement is also a silicate of lime and alumina, the strength of which depends on the silication, so that *clean* ballast can be considered in the same category as granite. It is, nevertheless, a difficult matter to obtain clean ballast, it is usually coated with clay and loam, which involves the expensive process of washing. The importance of a clean aggregate is far too frequently ignored. Cement is virtually a binding agent, which crystallizes in the process of setting and interlocks the particles or ingredients of the concrete. It is therefore apparent that if the aggregate is coated with clay or loam, as in the case of ballast, the binding is ineffective, and the resultant concrete is not monolithic.

"This article would be incomplete without some reference to the outstanding disqualification of slag and coke breeze as aggregates for reinforced concrete. One of the characteristics of a good slag is its porosity, and therefore, as it has already been explained, it does not provide adequate protection to the reinforcement, and it is unduly amenable to climatic variations. Slag really needs special preparation if it is to be used successfully as an aggregate; in other words it requires "seasoning"; it should be left exposed for some considerable time after it has been twice burnt. Its unsuitability lies chiefly in its sulphur content, which is injurious to the reinforcement, as it decomposes to form acids.

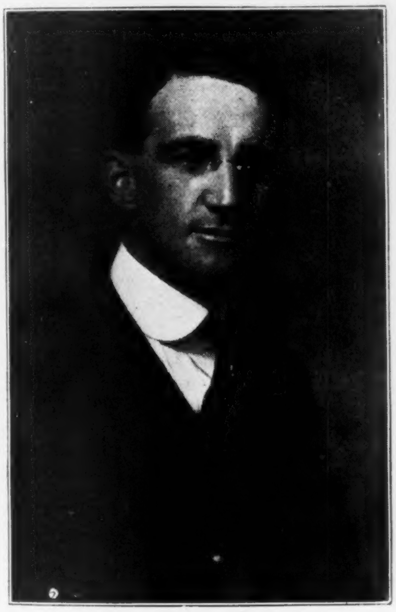
"Coke breeze also contains chemical impurities, ammonia being probably the most prevalent, although a large percentage of sulphur is frequently contained in some specimens. Both slag and coke breeze also contain pumice, which is not a suitable material for the surface of a road. It may be quite satisfactory as an aggregate for a surface which is not subject to the wear and tear of traffic, but when a road surface is being laid with reinforced concrete, the durability of the aggregate is a most important factor."

Meeting of National Sand and Gravel Association to be at St. Louis

Convention Will Be Held January 23 and 24, in the Same Week Crushed Stone Association Meets—Many Important Subjects to Be Brought Before the Members

AT a meeting of the Executive Committee of the National Sand and Gravel Association, held at Hotel La Salle, Thursday, September 27, it was decided to hold the next annual convention of the association at St. Louis, January 23 and 24, 1924. This is the same week that the National Crushed Stone Association meets in St. Louis, and this will permit the attendance of many persons who are interested in both conventions. The directors' meeting will be held January 22.

No program has been decided upon or even discussed at length, but all sand and gravel men may be assured that the convention will be well worth attending; that the program will be something more than



Alex W. Dann, president of association

a dry discussion of technical details and that speakers of national reputation will be present. The Executive Committee will present its report on the all important matter of cost keeping, also the reports on the use of cars as affected by the coal situation and various other matters which are of the greatest importance to the entire industry.

This is the first convention of the association to be held since the incorporation, for the National Sand and Gravel Association became a legal incorporation last June, incorporating under the laws of the District of Columbia. It is on this ac-

John Prince secretary-treasurer

count that the coming convention will be important, as it is thought that there are certain legal formalities to be considered which can only be done by a meeting of the members who correspond to the stockholders of a business incorporation.

The report of the secretary-treasurer, John Prince, showed that the association is now in excellent financial condition. The Bulletin, the organ of the association, is now practically self supporting.

The decision to meet at St. Louis was reached with very little discussion. According to a vote of the convention it was required that a point somewhere in the Central States should be chosen and Chicago, St. Louis and French Lick were suggested. A representative from French Lick was present and spoke to the committee on the advantages of that place, but it seemed to be the sense of the committee that the members would desire to meet in a large city rather than in a resort. The convention has several times selected Chicago as a meeting place, and it was thought that a change would be desirable, and hence the decision to meet at St. Louis.

Beside the regular business of the meeting there was considerable informal discussion on subjects of interest to the sand and gravel industry. Among these were the relation of the industry to the coal industry, as regards the use of cars and rating of plants, and the attacks which have recently been made upon gravel by the sellers of other kinds of aggregate.

Those present were: Alex W. Dann, president; E. Guy, Sutton, vice-president; John Prince, secretary-treasurer; R. C.

E. Guy Sutton vice-president

Fletcher, Hugh Haddow, G. C. Ross and T. R. Barrows, executive secretary.

C. A. Homer of the Missouri Portland Cement Co. of St. Louis was chosen chairman of the Convention Committee, with authority to choose the other members. T. R. Barrow, executive secretary, was declared an ex-officio member of the committee.

Constitution of Portland Cement

III—Discusses the Possible Reactions Between Silica and Lime and Compounds Formed at Different Temperatures

By J. E. Duchez

Translated from the French Revue des Materiaux de Construction by C. S. Darling, Former Editor of Rock Products

A NUMBER of very competent engineers have written, on the study of the constituents of cement, works of great interest in which they have brought the tribute of their science and their actual experiments. We have dipped largely into these learned works which we shall mention in the text, reserving to ourselves, outside of a few personal experiences, only the merit of having chosen and co-ordinated the different documents and finally arranged the remarks in such an order as 12 years of practice in the construction and operation of factories, as well as visits to more than 200 installations, could suggest to us.

Possible Reactions Between Silica and Lime

The silicates which can be formed by a combination of silica with lime during the burning correspond to the following silicates:

Monocalcic silicate SiO_2CaO
Bicalcic silicate SiO_22CaO
Tricalcic silicate SiO_23CaO

and the intermediate silicates with 1.5 and 2.5 molecules of lime $SiO_21.5CaO$ or tricalcic bisilicate $2SiO_23CaO$ and $SiO_22.5CaO$ or pentacalcic bisilicate $2SiO_25CaO$.

We shall study each of these silicates specifically.

Study of Calcium Silicates

The monocalcium silicate or metasilicate of lime (SiO_2CaO) is known in its natural state under the name of wollastonite. It is a constituent of *archeennes* and metamorphic rocks.

This silicate has been obtained in the laboratory by fusing together a molecule of lime for each molecule of silica.

$$SiO_2+CaO=SiO_2CaO$$

We find this in this form in certain slags of the blast furnace; in this case it presents a different crystallization from that of natural wollastonite and for this reason it has been given the name of pseudo-wollastonite.

This silicate when pulverized and moistened with water does not harden. It presents therefore from the point of view of the study of hydraulic cementing materials only a relative interest and the studies made by Day, Shepard, and Le Châtelier on this subject had as their object especially the study of the geological formation of rocks.

If we increase the amount of lime in the fusing mixture so that it carries a molecule and a half, we obtain the tricalcic bisilicate $2SiO_23CaO$ or $SiO_21.5CaO$—which, like the monocalcic silicate, gives a fused mass of yellowish color and a porcelain appearance.

M. Le Châtelier, in his book, "Constitution of Hydraulic Materials," indicates that the fused mass of silicate $SiO_21.5CaO$ pulverizer on slow cooling, giving, together with the dust, quite an important portion of fragments not pulverized, large enough so that one can cut them into thin slices. Examined under the polarizing microscope very brilliant surfaces of double refraction are noted, like those which are distinguished with the monocalcium silicate and which, as a result, indicate the presence of wollastonite.

Pulverized and sprinkled with water the part remaining solid remains inert during about 15 days, but afterwards undergoes a slight and slow decomposition, with the formation of elliptical crystals of elongated form and pointed at one extremity. Besides, there are formed large hexagonal crystals similar to those which are encountered in the cements and which characterize pure hydrate of lime.

If we increase the amount of lime to two molecules,

$$SiO_2+2CaO=SiO_22CaO$$

we obtain the bicalcic or dicalcic silicate which is also called orthosilicate of lime SiO_22CaO.

This silicate does not exist in the natural state.

LeChatelier's Experiments

M. LeChâtelier has obtained it in the laboratory and while the two silicates previously studied were formed at around 1500 deg. C., the bicalcic silicate requires a heat of 1600 deg. C. If removed hot from the crucible the fused mass remains compact and very hard while if allowed to cool slowly in the crucible it becomes pulverized forming a white or gray-white powder.

The reaction in the two cases is undoubtedly complete since by treating with acids there is immediately noticed a deposit of silica. This phenomenon of spontaneous pulverization is due to a very interesting cause which we can easily follow and which we will attempt to explain below:

If we place in contact in a crucible two molecules of lime for one of silica there is formed at about 1500 deg. C. a solution of metasilicate of lime SiO_2CaO and of lime CaO:

$$SiO_2+2CaO=SiO_2CaO+CaO$$

If the temperature is increased, the fusion being aided by the formation of the metasilicate, the remaining molecule of lime is dissolved in the metasilicate and forms the orthosilicate of lime:

$$SiO_2CaO+CaO=SiO_22CaO=Si\left\{\begin{matrix}{}^{O}_{O}>Ca\\ \\ {}^{O}_{O}>Ca\end{matrix}\right.$$

The orthosilicate thus obtained at 1500 deg. C. or at any temperature below its point of fusion, 2080 deg. C., is a neutral orthosilicate but if we raise the temperature we increase the mobility of the atomic groups, the orthosilicate of lime is transformed into a dicalcic metasilicate isomer the structural formula of which is:

$$SiO_22CaO=SiO\left\{\begin{matrix}O\,Ca\\O\,Ca\end{matrix}\right.>O$$

This basic metasilicate, which exists only at a high temperature, cannot remain when the temperature is lowered slowly. The mobility of the group of atoms not being retarded, there is produced the inverse transformation into orthosilicate. We can represent schematically this reversible reaction by the following formula:

$$Si\left\{\begin{matrix}{}^{O}_{O}>Ca\rightarrow\\ \\ {}^{O}_{O}>Ca\leftarrow\end{matrix}\right. \quad SiO\left\{\begin{matrix}O\,Ca\\O\,Ca\end{matrix}\right.>O$$

But if we suddenly arrest the mobility of the groups of atoms by a sudden chilling of the fused mass, the dicalcic metasilicate remains without transformation.

The orthosilicate of lime pulverizes of itself on slow cooling and when moistened with water these powders do not set. However, they react eventually and even quite strongly if they are subjected first to grinding in a mill.

Its isomer, the dicalcic metasilicate, remains solid after sudden cooling; if pulverized and moistened with water, it hardens and hydrates according to the following formula:

$$\mathrm{SiO}\begin{cases}\mathrm{O\,Ca}\\ \mathrm{O\,Ca}\end{cases}\!\!>\mathrm{O}+\mathrm{H_2O}=$$
$$\mathrm{SiO}<^{\mathrm{O}}_{\mathrm{O}}>\mathrm{Ca}+\mathrm{Ca(OH)_2}$$

or with the simplified notation

$$\mathrm{SiO_2 2CaO}+\mathrm{H_2O}=\mathrm{SiO_2CaO}+\mathrm{Ca(HO)2}$$

On examining under the polarizing microscope the hydration of the pulverizing parts of this silicate we notice the formation of large hexagonal crystals of hydrate of lime and we notice in the field of the plate the very slow separation of a colloidal mass. The parts remaining solid when pulverized react with water and give at the end of six to eight days a certain quantity of hexagonal crystals and toward the fifteenth day, even more rapidly sometimes, there separates a gelatinous mass with the formation of long fine needles radiating from a central point.

Keisermann has shown that these long, fine needles are characteristic of a silicate of lime. The cement is weak, and that is explained easily by the presence of voids between the crystals. Jordan and Kanter noticed the formation of the same long fine needles in the hydration of the puzzolanic mixture of pure hydrate of lime and of hydrated silica. They have determined the qualitative composition of these needles to which they give the formula $\mathrm{SiO_2CaOaq}$.

If the lime content of the mixture in fusion is increased to 2.5 molecules of lime, the mass provides the same observations as those already explained so far as the spontaneous pulverization on slow cooling is concerned. The reactions with water give the same indications, that is to say concerning the formation of long, fine needles and large hexagonal crystals. This must then be a solution of lime in bicalcium silicate.

The phenomenon of spontaneous pulverization is of highest importance for the theory of hydraulic binding materials—below are the practical deductions which follow.

1. Refractory properties of portland cement clinkers.

We have seen that bicalcic silicate is formed by the fusion of lime in monocalcic silicate at about 1500 deg. C. and that the fusing point of bicalcic silicate is above 2080 deg. C.

At its formation at 1500 deg. C., the bicalcium silicate therefore solidifies since the temperature of its fusing point is not reached in the kiln. In order to again melt the bicalcic silicate it is necessary that the temperature of the kiln reach that of its fusing point, 2080 deg., but this temperature is never reached practically in the manufacture of cement by incipient fusion.

Clinker as a Refractory

This explains why it is possible to use in the construction of cement kilns, in place of a refractory, clinker which has already been burned, since when again subjected to the heat of the kiln it fuses only at a temperature higher than that attained in the kiln. This property of clinker is little used in the construction of vertical kilns, but its use is common in the lining of rotary kilns.

2. Explanation of certain burning phenomena.

The bicalcic silicates obtained by fusion at 2080 deg. and below have been studied by Day Shepard, and Le Châtelier. These investigators have recognized three polymorphous silicates stable at different temperatures.

The fused silicate crystallizes at 2080 deg. giving a first allotropic variety *alpha* which crystallizes in the monoclinic system, its density is 3.27, and its hardness from 5 to 6 by Mohs' scale. It remains stable down to a temperature of 1410 deg., and below this is transformed into a new variety *beta*, if the cooling is sufficiently slow. If on the other hand the cooling is sudden, bringing the temperature instantly from above 1410 deg. to a surrounding temperature below 675 deg. the variety *alpha* remains at ordinary temperatures, while the variety *beta* is transformed below 675 deg. to a new variety *gamma* which pulverizes, accompanied by a considerable increase in the volume of the mass.

The Stable Alpha Variety

The variety *alpha* remaining stable corresponds to the basic bicalcic metasilicate indicated already by the formula:

$$\mathrm{SiO}\begin{cases}\mathrm{OCa}\\ \mathrm{OCa}\end{cases}\!\!>\mathrm{O}=\mathrm{SiO_2 2CaO}$$

while the variety *gamma* corresponds to the neutral orthosilicate with the formula:

$$\mathrm{Si}\begin{cases}{}^{\mathrm{O}}_{\mathrm{O}}>\mathrm{Ca}\\ \\ {}^{\mathrm{O}}_{\mathrm{O}}>\mathrm{Ca}\end{cases}=\mathrm{SiO_2 2CaO}$$

These varieties *alpha* and *gamma* of the bicalcic silicate correspond to determined conditions of temperature, the first existing above 1410 deg. and the second by sudden cooling from 1410 to 675 deg. But in practice these conditions of cooling the clinker vary with the types of kiln and the method of their operation and it is very likely that the qualities of the clinker or the form of the crystals vary in a manner similar to the variation of steels under varying conditions of tempering. It is therefore very likely that the same raw material or finished cement should act differently according to the temperature of the kiln and the method of cooling, and there should be an infinite quantity of *beta* silicates following the moment at which the mobility of the atomic groups is stopped.

These bicalcic powders were noticed in 1910 and 1911 at the time the vertical kilns of a factory in Puy-de-Dome and one in Gers were put in operation.

The mass of burned material arriving at the base of the kiln formed compact blocks which the temperature of the central portion maintained at about 700 to 800 deg. This temperature was verified by the fact that the grate bars of the doors were a dull red. In a few hours these blocks, which nothing could break, were reduced to an exceedingly fine gray powder running all around the kiln and flooding the kiln floor. This hot powder, at a temperature above 200 deg. C., allowed no approach to the drawing gates, and continued to be produced without any way of stopping it.

The formation of this powder was due to the slow cooling of the *alpha* silicate which was transformed, below the burning zone, into the *beta* silicate and finally into *gamma* silicate on arriving at the bottom of the kiln, under the slow action of the surrounding temperature. The factory at Gers had to abandon the manufacture of artificial cement, even though with a rotary kiln they surely would have had good results. How many quite modern factories are in the same position and through the same fault of using a vertical kiln, which is absolutely contrary to theory, in the manufacture of artificial cement.

The formation of the powder at the moment of tapping (or drawing) took place with an increase in temperature verified by the appearance of luminous streams, especially visible at night and resembling streams of phosphorescent grains on the gray powder. This increase in temperature has been verified in the laboratory by M. Le Châtelier.

This phenomenon of spontaneous pulverization is also known in metallurgy. It is noticed with all blast furnace slags which are sufficiently high in calcium when they are allowed to cool on the cinder beds or in the runways. The opposite phenomenon is noticed when melted slag is plunged into water. The slag granulates and remains stable in the form of small solid grains of sand.

In the first place the *gamma* silicates are formed, which explains the lack of hydraulic properties in non-granulated slags even though as a result of granulation there is obtained the *alpha* silicate which has all the hydraulic properties.

In rotary kilns used in burning cement, the zone of complete combustion is several meters from the discharge point of the kiln and the temperature in this zone is usually above 1450 deg. The *alpha* silicates are formed by the lime of the monosilicate coming out of solution, and the fall into the cooling compartment, even though the bicalcic silicate thus formed is at a temperature of about 1400 deg., produces a sudden cooling which assures the stability of the *alpha* form. This explains the small amount of powder contained in the clinker from rotary kilns.

Combustion in Vertical Kilns

In the vertical kiln the passage of the product from the burning zone to the drawing gates takes place slowly and the clinker takes a very long time in passing through the temperatures between that of burning and that of the surrounding air at the drawing gates. There is therefore a slow cooling

and the resulting impossibility of assuring the proper tempering, beyond a judicious regulation of the temperature in the burning zone; there is formed as a result a large proportion of the *gamma* silicate, at times more than a third of the total product drawn, with a very noticeable lowering of the quality of the cement obtained from the vertical kiln in respect to the rotary kiln.

These remarks on the spontaneous pulverization of clinker are not peculiar to the bicalcic silicate. The same phenomenon is noticed for the silicate with 2.5 molecules which we have studied, as well as for the silicate with three molecules of lime which we are going to study.

Tri-Silicate of Lime Experiments

If a molecule of silica and three molecules of lime are melted together, we should obtain the tricalcic silicate $SiO_2 3CaO$.

$$SiO_2+3CaO=SiO_2 3CaO$$

M. Le Châtelier has been able to obtain this silicate by heating chlorosilicate of lime in a current of steam at 600 deg.

$$SiO_2 2CaOCaCl_2+H_2O=SiO_2 3CaO+2HCl$$

The mass being readily pulverized, he was not able to identify the crystals obtained as the same as those encountered in the cements.

M. Le Châtelier and M. Bied recognized the presence of this silicate in particles of lime, in small quantities and against the walls of the kiln. In no case, even in fusing the mass at a temperature above 2000 deg., was M. Le Châtelier able to reproduce tricalcic silicate directly.

When three molecules of lime and one of silica are fused in a crucible, the residuum remains stable on sudden cooling and pulverizes on slow cooling. This must be a solution of lime in bicalcic silicate, and the latter obeys the phenomenon of spontaneous pulverization:

$SiO_2 2CaO+CaO$, instead of $SiO_2 3CaO$

During the hydration exactly the same phenomena are noticed as for the bicalcic silicate or that with 2.5 molecules of lime. There is a formation of large hexagonal crystals and the separation of a gelatinous mass with the formation of long fine needles radiating from a central point.

The hydration must be as follows:

$$SiO_2 3CaO+water=SiO_2 CaOaq+2CaOaq$$

Conclusions on the Study of Calcium Silicates

The study of the silicates between SiO_2-CaO and $SiO_2 2CaO$ appears to have no interest in the constitution of the cements, since their hydration results in elliptical, elongated, and pointed crystals which are not found in the hydrated cements.

Only the silicate between $SiO_2 2CaO$ and $SiO_2 3CaO$ seem interesting, since its hydration results in fine needles radiating from a central point, such as is found in the hydration of all cements, with the formation of more or less important large hexagonal crystals of hydrate of lime.

According to Jordan and Kanter, the result of the hydration of these silicates would always have the formula $SiO_2 CaOaq$, with a more or less important quantity of hydrate of lime set free, this quantity increasing as the product before hydration approached $SiO_2 3CaO$. M. Le Châtelier, in his book "Constitution of Hydraulic Mortars" seems to indicate as the formula of the hydrated silicate $SiO_2 1.7CaOaq$, but he agrees equally to the formula $SiO_2 CaOaq$.

The formulas of hydration for the silicates $SiO_2 2CaO$ and $SiO_2 3CaO$ would be then:

$$SiO_2 2CaO+aq=SiO_2 CaOaq+CaOaq$$
$$SiO_2 3CaO+aq=SiO_2 CaOaq+2CaOaq$$

We should have, then, from the mechanical point of view, more resistant hydrolites from $SiO_2 2CaO$ than from $SiO_2 3CaO$, because of the smaller amount of the weak element $Ca(OH)_2$.

The question of the bicalcic silicate is evidently not solved in this manner, for from the point of view of mechanical strength of a mixture of crystals, the definite result does not correspond to the average of the strengths of each of the elements. The factors of adhesion and cohesion play an important part.

Adhesion is a function of the chemical nature of bodies in contact and of the condition of the surfaces of contact due to the form of the crystals. Cohesion is a function of the volume of voids and of the distribution of the voids among the crystals and of the method of filling these voids.

The American Theory

The Americans claim that the *alpha* form of the bicalcic silicate conserved cold through tempering is hydraulic and from this they deduct, as we do, that this fact explains the small amount of powder encountered in the rotary kiln clinker. Now, in a recent article, M. Bied (R. M. C. 1922) says that the numerous experiments he has made with the *alpha* and the *gamma* bicalcic silicates have never given him—in a neat cement—a sufficiently hard setting cement to permit the conclusion that this substance was the principal constituent of cement. It is true that the *alpha* or *gamma* bicalcic silicate, or that obtained by an intermediate tempering giving the *beta* silicate, never show high strength, even after pulverizing the crystals of *gamma* silicate. This is explained by the lack of surface of contact and the numerous voids the existence of which has been determined between the crystals of hydration of these silicates; but we shall see in the study of the aluminates that the fine needles or lamella of hydrated aluminate of lime intercalate in the voids and give to the hydrated cement the cohesion and adhesion which are lacking in the bicalcium silicates alone.

We ourselves are less affirmative than the Americans on this subject, for the examination in polarizing light even with colorings does not permit the isolation of crystals other than those which we have noted in the hydration of the silicates with 2, 2.5, and 3 molecules of lime. However, we are persuaded that the silicate which is formed in the normal manufacture of cement is a silicate which is bicalcic or approaches bicalcic, having at the most 2.5 molecules of CaO. This leads to the recommended formula: $4(SiO_2 2CaO)+Al_2O_3 3CaO$, or to that of M. Hendrickx: $x(SiO_2 2.5CaO)+Al_2O_3$-$3CaO$, the closest ones to the formula deduced from that of the average of cements given in the work of M. Candlot:

$$3.84(SiO_2 2.35CaO)+0.99(Al_2O_3 3CaO)$$

It is certain that the elements of the silicate formed must occur in the approximate ratio of

$$4SiO_2+8CaO$$

if the cement is to contain in proportion $Al_2O_3 3CaO$.

In any event the silicates between SiO_2-$2CaO$ and $SiO_2 3CaO$ show the same allotropic phenomena as the silicates $SiO_2 2CaO$, and we do not believe that merely the presence of alumina or iron can hinder the phenomenon of spontaneous pulverization from occuring.* M. Bied points out that the formation of these powders, in practice, is well known by cement manufacturers, and that there is no kiln and particularly no blast furnace, which does not produce a certain quantity. He indicates that if this powder from the blast furnace is screened the product under 4900 mesh (N. C. R.: In our units this would be 175 mesh) remain inert under the action of water while the product over this size, when plverized and moistened, will harden. He explains this phenomenon by attributing to the *gamma* bicalcic silicate the power of carrying with it in its spontaneous pulverization small cement particles larger than the 4900 mesh screen. Evidently this occurs in practice, and as M. Bied does not indicate the chemical composition of the cementing particles thus separated, it is difficult to draw any conclusion, for they could be composed of particles of calcium aluminate or aluminoferrites of lime and harden more or less rapidly.†

Stability of Clinker from Rotary Kilns

In any case, if the increasing strength of cement burned in rotary kilns, or the stability of the clinker from rotary kilns can not be explained by the tempering of the silicate, it must be admitted that it is the method of burning which has produced a modification of the constituent or in the crystallization of the constituent, whether because of the temperature or the method of cooling. One certain fact is that the phenomenon of spontaneous pulverization of

*Fused alumina cement pulverize spontaneously in spite of their high alumina content. It is true that in certain cases they remain stable.

†This explains why the powder of burned cement hardens.

the clinker corresponds in all points, in practice, with the phenomena observed in the laboratory for bicalcic silicate. Equally certain it is that all cement proportioned according to the formula SiO_23CaO give the maximum limit of lime content and that the authors or the users of the formulas themselves indicate that they hold in practice slightly under the formula in order to avoid leaving part of the lime uncombined and thus obtaining an expanding product.

If the proportions are formed with a formula approaching SiO_22CaO, the risk of spontaneous pulverization is greater and the manufacture in vertical kilns becomes difficult because of the slow cooling which becomes necessary.

The rotary kiln has its burning zone near the mouth of the cooler, the clinker passes suddenly from a temperature of about 1400 deg. to a temperture below 600 deg. and it therefore fulfills all the theoretical and practical conditions to assure the tempering of the clinker and the retention of the silicates in the *alpha* form. It permits, besides, by deduction, the use of formulas of proportioning not requiring empirical corrections to avoid the presence of free lime and the resulting expanding products in the cement.

(To be continued)

Plaster of Paris*

II—American and English Systems of Calcination Described and Compared†

By A. Brittain, M.Sc., A.I.C., and C. Elliott, B.Sc.

THE kettle system of calcining gypsum is employed almost exclusively in the United States and Canada, and in course of time the plant has become more or less standardized, both as regards the complete process and the kettles themselves as a part. The kettles made by the different makers are practically identical, except in minor details.

These kettles are hollow cylinders which vary in diameter from 4 to 14 ft., and in depth from 4 to 8 ft. They hold a charge of gypsum varying from 1½ to 20 tons, according to size. Kettles of larger capacity have been made in isolated cases, but the most favored sizes appear to be 8 ft. diameter by 8 ft. deep, holding some 6-7 tons, and 10 ft. diameter by 8 ft. deep, holding 12-14 tons. To secure a good distribution of the heat throughout the whole mass of material, horizontal iron flues are inserted across the kettle, two being employed in the smaller and four in the larger types. If solid fuel is to be burnt the fire grate is placed some 6 or 7 ft. below the kettle bottom, on which the hot gases impinge. The products of combustion pass through tuyeres extending round the greater part of the furnace, circulate around the circumference of the kettle, through the flues and finally discharge to the atmosphere through a chimney. Efficient agitation is effected by stirrers provided with arms, and frequently chains are added which drag along the bottom. The vessels are completed with covers, in which are inserted openings for the running in of the gypsum, for the escape of the steam and dust, and for inspection purposes, while at the bottom of the vessel is an outlet for discharging the calcined material.

*Read at a meeting of the Nottingham Section on February 21, 1923.

†Through error, installment III was published in Rock Products September 7, 1923, ahead of installment II here published.

The following table gives a few particulars of standard kettles:

TABLE I.

Diameter in feet	4	6	8	8	10	12	14
Height in feet	4	6	6	8	8	8	8
No. of flues	2	2	2	4	4	4	4
Capacity in tons	1-1½	2-3	5-6	6-7	12-14	15-18	20-25
H.P. required	4	8	15	15	25	38	50

Method of Working.—The ground gypsum, which is stored in an overhead bin, is allowed to fall into the kettle at such a rate that the steam arising from the material keeps the mass in a fluid condition. If it were fed in too quickly agitation would be more difficult, and a heavy strain would be thrown on the stirring gear. After the addition of the gypsum the temperature rises to the transition point corresponding to the rate of heating in each particular case, but within the range of 110 to 130 deg. C. (230 to 266 deg. Fahr.). The whole mass "boils" vigorously and rises in the vessel. This boiling is continued until practically all the gypsum is converted into hemihydrate. The temperature then rises rapidly and the boiling decreases until in the neighborhood of 140 to 154 deg. C. (290 to 310 deg. Fahr.) it has almost ceased, and the whole mass settles down in the pot, decreasing by 12 to 16 per cent of its volume when boiling. The mass is now very difficult to stir and severe strain is thrown on the stirring gear. This comparatively quiet condition is called the "first settle."

With further heating the temperature continues to rise, and boiling starts again at about 190 deg. C. (375 deg. Fahr.), when the temperature again remains steady for another but shorter period, this being the transition point for hemihydrate into soluble anhydrite. This boiling continues until practically all the water is given off, when the mass would again settle down in the kettle to less volume than in the case of the first settle. This stage is known as the "second settle." The product is run off just before the end of the second steady period before it has time to slump and while it is still free-running.

Calcination of the gypsum can be stopped after the first steady, or towards the end of the second steady, according to the nature of the product required. If ordinary plaster is required, the material is run out at any time after the end of the first and before the second steady. If, however, soluble anhydrite is required, the kettle is discharged towards the end of the second steady. Soluble anhydrite takes up moisture from the air quickly, and unless used soon after manufacture it reverts to hemihydrate. When it has thus changed, however, it gives a much stronger and denser material on rehydration than ordinary plaster, and is used where strength is desired as in bedding plate glass for grinding. It is, of course, more costly to make than ordinary plaster, and is chiefly employed in the manufacture of gypsum blocks and tiles, since having a quick set (from ½ to 1 min. upwards, when fresh) the manufacture of these commodities by automatic machinery is considerably facilitated.

The calcined material is run from the kettle into a brick-lined storage bin, whence it is removed by a conveyor for sieving and bagging as desired.

The time to fill a kettle depends on the fineness of the grinding and the amount of hygroscopic moisture. To charge a 14-ton kettle requires 30 to 90 min., or longer if the gypsum is damp, but since in most plants the gypsum has been dried before grinding 60 min. is a fair average.

The time taken for calcination varies according to the rate of heating and the size of the charge. Under ordinary conditions and natural draught, the plaster would be run out about 2½ to 3 hr. after the time charging was started, but in bad cases the

total time may be anything up to five hours, while under forced draught this may be as low as 1½ hr.

Continuous Rotary Processes

In the continuous rotary process, lump gypsum is subjected, for a short time only, to the hot gases from a furnace. The general principle employed in the various types is the same, and therefore it will be sufficient to describe in detail the Cummer process, named after the firm who manufacture the plant.

The Cummer rotary calciner consists essentially of a slow-rotating cylinder, about 30 ft. long by 5 ft. diameter, slightly inclined to the horizontal and supported on rollers and extended trunnions, the rotary movement being imparted by suitable gearing. This cylinder is enclosed on the top and sides by brickword and at the ends by steel plates. Immediately below and extending the whole length of the cylinder is a perforated brick arch, and below this arch is a series of brick air chambers with perforated tops. The hot gases from a furnace placed behind the cylinder housing and at its higher ends are drawn by a fan into the space between the perforated brick arch and the air chambers mentioned above. In this space, called the commingling chamber, the gases mix with, and are cooled by, the air entering from the air chambers, so that by proper control the degree of heat can be kept reasonably constant. The cooled mixture then passes through the perforated arch into the space surrounding the rotating cylinder, and thence into cylinder itself by a series of openings in the shell. These openings extend in a spiral around the cylinder, and to prevent the crushed gypsum falling through, they are provided with hoods. Some gases also pass into the cylinder at its lower end.

Running along the entire length of the cylinder are longitudinal blades or shelves, so that the material is being continually lifted and cascaded down again.

The gypsum rock is crushed to ¾ in. lumps and elevated into a storage hopper. From this it is fed automatically into the higher end of the cylinder, through which it passes contraflow to the gases. The partly calcined material falls from the lower end of the cylinder into a small brick bin, whence it is continually removed by an Archimedean screw.

The total time that the gypsum is in contact with the hot gases is only about 10 min., and during this time it has lost all its hygroscopic moisture and some of its combined water. As it leaves the calciner it is steaming and heated uniformly to a temperature between 200 and 300 deg. C., the exact temperature depending on the density of the rock and the kind of product desired. It is claimed that by watching a recording thermometer placed in the discharge and regulating the cooling air, the temperature can be maintained to within 10 deg. Fahr.

To complete the calcination the hot material is elevated to large bins made of brick, or wood lined with brick, where it is kept for several days. Four such bins are required, and each bin holds the output for 24 hr. from one calciner, which is about 50 tons. The provision of four bins allows continuous working, for one can be discharging and another filling, while the process of final calcination is being completed in the remaining two bins.

The temperature at which the material enters the bins affects the time of set since, as will be discussed later, the relative proportions of "dead-burnt" ıster, slow-setting anhydrite, hemihydrate and unchanged gypsum will vary according to the temperature.

The cool calcined material after removal from the bin is ground in buhr mills or emery wheels, and since the material has been severely shattered by the heat, the power required is very much less than when grinding precedes calcination. The product is also finer and the wear and tear on the grinders is less.

The following table gives particulars of the calciners:

TABLE II.

No. of machines	Capacity, tons per 24 hrs.	H.P. needed	Coal per day, lb.	Labor per shift, men
1	50	6	3,500	1
2	100	8	7,000	1
3	150	10	10,500	1
4	200	12	14,000	1

The Cummer process is in use at six mills with a combined capacity of 1000 tons per day, although the machine has found much more use as a drier for various materials, including gypsum.

To avoid the use of bins, one firm in America has installed rotary calciners 70 ft. long, like those used for portland cement, in which the hot gases enter at one end and leave at the other, while the gypsum passes through counter flow.

Another rotary calciner is the Mannheim, in Germany, described by F. A. Wilder (Iowa Geol. Survey, 12, 1901), in which the hot gases and gypsum pass through a rotating cylinder in parallel flow, the gypsum being dried and preheated by the waste gases in a fore-warmer above the calciner proper.

English Open Pans

In this country the greater part of the plaster is manufactured in large open pans, and the quantity of gypsum calcined in one unit is considerably less than that dealt with by one kettle or rotary calciner. These open pans have flat bottoms composed of cast-iron plates, 2 in. thick, in the more recent and of clay tiles in the older types. These bottoms are carried by the arches of horizontal flues, which conduct the products of combustion from a furnace backwards and forwards under the pan until the gases are discharged into the chimney. The diameter varies from 14 to 22 ft. and cast-iron or steel sides are employed. Stirring is effected by slowly rotating arms carrying scrapers and heavy chains which drag along the bottom, the gearing being carried by horizontal girders extending across the pan. In some cases chains only are employed to effect the necessary agitation.

The charge of gypsum varies between 2 and 4 tons. Thus, a pan 22 ft. diameter would hold about 4 tons, the depth of the charge being about 6 in.

Since the heat has to pass through at lease 4½ in. of brickwork—i. e., the arches of the flues, and then through the cast-iron plates or tiles, the temperature of the pan bottom is not very high, and consequently the inversion point into hemihydrate occurs at a correspondingly low temperature, which varies between 110 deg. C. and 120 deg. C. While the "boiling" is in progress, the material flows almost like water and the chains and scrapers move through it easily, but towards the end of the boil the plaster begins to ride before the chains. This is generally taken as a sign that calcination is completed and the material is run out.

(To be continued)

Superstandardization

HAVING achieved much in the way of standardization, we must now proceed to superstandardization, according to Frank B. Gilbreth, who writes of it in the *Chemical Age*. He explains the term by saying:

"Changes cost time and money. They may, under certain conditions, be worth the money, but the fact remains, as Adam Smith emphasized nearly 150 years ago, that the great cost of changing from one kind of work to another is almost universally unappreciated. Superstandardization aims consciously at the ideal of the One Best Way, giving it the stamp of approval of permanence, and making changes that are definite, progressive and stabilizing, and that will pay in money or in durable satisfactions.

"Much work in standardization has been done both in this country and abroad, but this standardization has not applied to methods and has not had in mind the One Best Way to Do Work. A careful investigation of the work of the Bureau of Standards and of the excellent publications of the American Engineering Standards Committee illustrates this. It is an important aim of superstandardization to bring to the attention of our research bodies the necessity for standardizing the *methods* of industry as well as the *equipment*. There has not been in this country to any such extent as abroad a widespread popular interest in standardization and in the work of those bodies that handle this subject; it is the second aim of superstandardization to arouse this interest, to foster the work already being done, and thus lead to a more rapid advance in this type of work."

New Machinery and Equipment

"High Duty" Bi-Polar Suspended Safety Magnet

A NEW type of Bi-Polar Safety Magnet has recently been put on the market by the Magnetic Manufacturing Co., Milwaukee, Wis., manufacturers of "High Duty" Magnetic Pulleys and Separators.

This magnet is of the horse-shoe form, which has been found to produce the maximum of magnetic energy, and is particularly designed to extract "tramp iron" and steel from all sorts of conveyed materials.

Fig. 1—This shows the High Duty Bi-Polar Safety Magnet as it is suspended above a conveyor ready to pick up any "tramp" iron

Magnetic pulleys are used in conveyors for the purpose of extracting the troublesome scraps of iron that find their way into all sorts of rock and other conveyed material, but owing to the difficulties encountered in existing plants they are not always convenient to install, particularly where no belt conveyors are employed and where the material is transported by means of chutes.

The "High Duty" Bi-Polar Suspended Magnet is particularly adapted to operate under these conditions. This magnet may be suspended over a conveyor belt, or chute, carrying the material, and no piece of iron is too large to escape its attractive influence.

The magnet as shown in Fig. 1 is suspended about 6 or 8 in. above the conveyor, either of the trough, or belt type, with the lower pole pieces crosswise to the flow of material.

Fig. 2 shows how a miscellaneous lot of iron and steel pieces are firmly held to the magnet until they are removed from time to time, thus effectively getting rid of the troublesome "tramp" or scrap iron.

The importance of this apparatus, as well as other well known types of equipment in the form of "High Duty" Magnetic Pulleys, has been realized for some time by mill operators and all industries using crushers or pulverizers are now adapting some sort of magnetic separating device to their plant to prevent damage and shut down to their apparatus by removing iron from their raw materials.

New Type of Magnetic Separator

THE Magnetic Manufacturing Co., Milwaukee, Wis., has designed and placed on the market a new type of magnetic separator which involves many new and useful improvements.

It has always been considered very essential that either wood or some other non-magnetic material be used in the construction of a magnetic separator in order to confine the magnetic lines of force to a point where the separation actually takes place. In this new type of separator the manufacturers have exploded this theory: This new separator known as the Type "H" machine is of all metal construction. The frame is of structural steel firmly bolted and braced and is so designed as to confine the lines of magnetic force to the point where separation takes place. In this design there are no leaks, that is to say the steel frame does not in any way effect the magnet nor is the steel frame effected by the magnet.

The magnet in the Type "H" machine is exceptionally strong, as the design allows the use of considerably more wire in the coil windings than in separators of other types. All electrical connections and lead wires are enclosed in an approved metal flexible conduit and all electrical and mechanical parts are readily accessible.

A decided advantage is had in placing the entire magnetic element above the shaker, as this overcomes difficulties formerly encountered. Where a part of the magnetic element is placed below the shaker, long pieces of steel such as nails, curled chips, etc., attach themselves to the separating element and are held in a vertical position sweeping from the shaker a considerable part of the non-magnetic material causing a considerable loss.

Type "H" separators are provided with tight and loose pulleys for belting directly to a line shaft, or can be furnished with motors mounted on the separator. Where no direct current is available, a small direct current generator is usually mounted

Fig. 2—The magnet with its load. Note how firmly all the pieces are held. Whenever there is an accumulation it is removed by the attendant

on the machine, all electrical connections are made. Switch panel with electrical instruments are mounted on the separator, thus providing a complete compact unit.

The use of magnetic separators is increasing and their cost is now considered one of the cheapest forms of plant insurance. The damage done by a single piece of tramp iron or steel getting into the plant might be more than the cost of an installation.

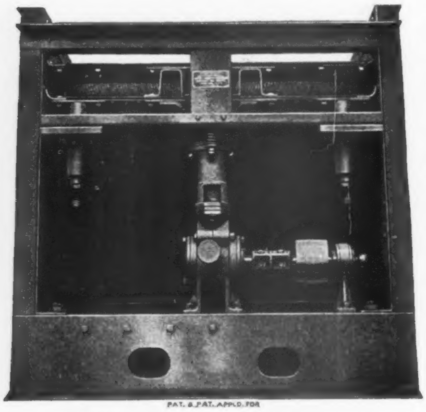
Screening Damp Sand and Gravel

By L. H. Sturtevant, V. P. & Gen. Mgr., Sturtevant Mill Co., Boston, Mass.

THE sizing of damp materials causes more trouble to the operator than any other one thing in a sand and gravel plant, and either means an unclean product, small production or a complete shutdown during inclement weather. The losses involved from this cause alone mean millions of dollars annually to producers.

The revolving screen or trommel fails utterly on the finer grades of work. Bumping screens are a failure and most vibrating screens are little improvement over the older methods.

Why is this work so difficult, and why has nothing heretofore been designed which will prove satisfactory?



Mechanism of Moto-Vibro screen

The answer is that the damp sand particles adhere so strongly to the gravel, to the wire and to themselves that heroic measures must be adopted to shake them loose and keep the screen meshes open to permit of reasonable tonnage and clean products. The revolving and bumping screens operate on the wrong principle to accomplish these results and vibrating or shaking screens soon destroy themselves by violent actions which crystallize and break the most rigid constructions. Therefore, the problem is to obtain violence, yet avoid breakage and not shake the building down.

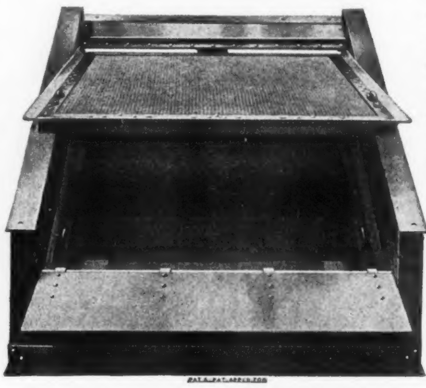
To accomplish this is no easy matter, yet it has been done, so that except under exceptional conditions capacity may be obtained and the output be clean and properly sized, if too fine a product is not expected.

To keep meshes open, vibration needs to be intense, every wire rapidly quivering and of only enough amplitude to force back all particles too coarse to pass through the screen openings and prevent wedging. If this vibration is sufficient no particle, no matter how damp, can adhere to the wire; also, if the pebbles are kept constantly hopping and rubbing against each other while in the air and on the screen surface, the adhering particles must be dislodged and when freed immediately pass through the open meshes.

Thus the successful factors include type, rapidity and amplitude of vibration sufficient to clean the pebbles of adhering particles and keep the meshes clear of obstruction, yet the vibration must be confined to the screen clothing, not destructive to it, and not transmitted to the screen housing, foundation or supports. This seems impractical of accomplishment, yet it has been done and is being done with concrete sand, which after all is the real proof.

The accompanying cut illustrates the successful mechanism which is a Heavy Duty Moto-Vibro Screen, built to handle large yardage of sand and gravel, or any other screenable material, wet, damp or dry, within reasonable limits. It consists of an open box (enclosed for dusty substances), amply heavy to support the vibrating mechanism. Within this box is placed one or two especially constructed screen frames covered with wire cloth. This frame is strong yet sufficiently springy to transmit vibration, like a tuning fork, to the screen wire attached thereto. The frame or frames are strongly pressed against a vibrating stirrup attached to a small throw, high speed eccentric of variable speed; thus the amplitude, intensity and rapidity of the vibrations may be tuned to suit the particular material being screened.

The result is a series of impulses similar to a massaging vibrator, railroad ballast tamper or the power riveter, varying in throw and speed according to conditions, confined to the wire and screen frame, light enough to hardly be seen, yet of such intensity as to sting the fingers when touched or of sufficient amplitude to throw a 2-in. pebble 10 ft. in the air. It is hard to conceive how anything can stick to the wire,



Box and screen are built to handle a heavy tonnage. Screen is enclosed for dusty substances

wedge in the screen holes or stick together when rattling over this rough and shivering surface.

Imagine a pebble coated with damp sand dancing up and down on a rough wire screen from 1800 to 3600 times a minute, bumping into other pebbles, bouncing here and there, receiving and giving sharp impacts, scouring against the hard wire with gaping openings ready to let the dislodged sand escape and rejecting the pebbles which are sent scampering down the screen to the reject pile.

Because the wire is continually jarred by continuous vibration, short and sharp impacts, the flexing is minimum and therefore it is not easily broken. It is neither dangerously stretched nor distorted. The screen frame is only supported by the casing so no crystallization or damaging shake is transmitted to either the case, foundation or building.

Driven by belt or motor, it is a simple and inexpensive device to buy, erect or run and is sold on approval to convince the most skeptical.

Safety Clamp for Wire Rope

FOR fastening wire rope a clamp with a U-bolt and self-tightening cam which it is claimed cannot slip or crush the cable is being manufactured by the Mal-Gra Casting Co., Cambridge City, Ind., under the trade name of the Keater safety clamp.

Safety clamp applied square with cable and tightened with a wrench

The clamp, as shown in the accompanying illustration, is applied square with the cable and tightened with a wrench. A feature of the device is the use of a grooved cam which serves the double purpose of protecting the cable from the concentrated pressure of the U-bolt and of providing an eccentric movement which causes it to increase its grip as the cable turns it under pressure. Only one clamp of the Keator type is said to be required for each cable. The self-tightening feature it is pointed out automatically compensates for the shrinkage of the cable under load, and merely grips the tighter as the load increases.

Concrete Road Across Dismal Swamp

A CONCRETE road 18 ft. wide is to be laid across the famous Dismal Swamp in Virginia, according to the Portsmouth, Va., *Star*.

This decision was reached on advice of County Road Engineer R. B. Preston, who estimated $27,000 a mile as the cost of concrete, $12,500 for waterbound macadam and $10,000 for clay-gravel. In the end, he said, clay-gravel will be more costly than macadam. The material will have to be barged down the James, costing as much to barge as crushed stone from Baltimore. It will not hold up under the anticipated heavy traffic without constant renewal, he said.

Some Jottings from the West Coast

Unbelievable Activity and Prosperity in Construction and Allied Rock Products Industries

By Nathan C. Rockwood
Editor and Manager, Rock Products

LOS ANGELES, Calif., September 29.—When I get back to Chicago from trips like this it is a regular thing for my associates to ask "How I enjoyed my vacation"; but I'll say there is no vacation in attempting in a week or two weeks to make a survey of developments in the rock products industry in a territory so much alive and so active and prosperous as this. One hardly knows where to begin and he certainly never knows when to leave off, for I could spend a year out here and fill every issue of ROCK PRODUCTS with new and interesting details of the plants built and plants projected.

Limestone Plaster

My first stop from Chicago was San Diego and, I presume, all who have read the very interesting articles by Cyrus Field Willard on his experiment in making plaster from raw ground limestone will want to know my impressions and conclusions about him and his process.

Unfortunately, as yet, I cannot draw any definite conclusions; but I found Mr. Willard a most interesting and remarkable personality—a man who has already solved some important problems in colloid chemistry relating to the devulcanization of rubber. He is tremendously interested in his present problem and has already made contracts with two limestone producers to give his process a thorough tryout. He has developed a plaster that undoubtedly would serve as well as, or possibly better than, many interior plasters now on the market, but some work remains to be done, or some problems remain to be solved, before it can be a serious competitor of either lime or gypsum plaster.

Other Workers in This Field

Since coming to Los Angeles I have stumbled on some similar work elsewhere; that is the application of the principles of colloid chemistry—geological chemistry—to making an artificial stone, which lead me to the belief that Mr. Willard is working along lines which will develop into something of great commercial importance to the rock products industries. Of course, the introduction of an entirely new material in competition with old and long tried materials, of well-known virtues, is not going to come suddenly, nor easily, from a business view-point, but the world changes and the rock products industry will surely change when men like Mr. Willard apply their knowledge and experience to some of the problems of cements and plasters.

Los Angeles a Wonder City

Building permits in Los Angeles are now averaging $1,000,000 per day. In August, which is usually the dullest month in the year here, permits exceeded $25,000,000 and this sum was claimed to exceed the sum total of building permits issued in 25 of the largest cities west of the Mississippi river for the same month! The population is increasing at the rate of 100,000 per year—the rate for the last three years—and there are no visible signs of a let-up. Savings bank deposits steadily increase in spite of the fact that there are over 325,000 pleasure automobiles in the city, and in spite of the fact that city lots, a dozen miles or more from the city proper, are selling regularly for $1500 to $2500 or more (60x125 ft.).

An ad that pulls business

Vast acreages are developed with paved streets, concrete sidewalks, curbs, sewer, water, etc., so that the demand for cement and concrete aggregates is tremendous, when all this construction is added to building of all kinds. Largely the new housing construction is of the stucco variety, calling for an immense amount of cement, lime, magnesia, sand and similar materials. Because of the high prices for structural steel nearly all the larger buildings are constructed of reinforced concrete.

The Busy Cement Plants

The cement plants are all as busy as can be. Practically all of them are steadily increasing their facilities. The Southwestern at Victorville is just putting a fourth kiln into operation. The Riverside has taken over and rebuilt and enlarged the old Golden State plant at Oro Grande, just beyond Victorville, while many improvements have been made at the Riverside plant. Probably both the Riverside plant and the nearby plant of the California Portland Cement Co. at Colton are producing as much cement daily as their limestone resources justify. That the project for a new plant for the Arrowhead Portland Cement Co., near San Bernardino, will go ahead seems to be assured, while another company is also contemplating a new plant.

Cement Situation

Many thousand tons of Swedish, English and German portland cement have been imported into Los Angeles during the summer. It is brought in at very low freight rates; in some cases, it is said, as low as 50 cents per barrel. It comes in 94-lb. jute bags, for which a rebate of 10 cents per bag is allowed. This cement has been sold for 10 or 15 cents below the market price for local brands, but the demand for cement has been so great that it is doubtful if these importations have seriously affected the production of local

plants. It is said that much of this imported cement will not pass American specifications; and a local dealer, who has imported considerable, told me today that, taking into account all the expenses of handling it and possible loss of the goodwill of local manufacturers, it did not make a very desirable commodity to deal in. Also, if such importations continue after local manufacturers have increased their capacities to take care of all possible demands, it is very likely that the United States Government will step in under the anti-dumping features of the present tariff laws and see that, at least, a fair ocean freight rate is paid on such cargoes.

Another factor which will probably be an important one is the expected demand for cement from Japan which will divert some of the present foreign cement to those markets, as well as increasing the demand for American-made cement.

Concrete Aggregate Situation

The city and county of Los Angeles are largely made up of plains composed of deposits of sand and gravel and silt washed down from the adjacent hills and mountains. Apparently one can dig a hole almost anywhere and find sand, gravel and boulders to an unknown depth. The quality and character of these deposits vary considerably, yet they surround the city on all sides.

Add to this fact the car situation, a scarcity of open-top cars, and the tremendous demand for concrete aggregates and you can easily imagine that there are plants galore. Railway cars that should be carrying sand and gravel or crushed rock (there is no coal traffic out here) are too much used for carrying lumber from the port of Los Angeles to the city, and in carrying equipment to the new oil fields near the port, to be much used by producers of concrete aggregates. Then, also, the city is surrounded by a network of paved roads, which make it possible for 10 to 12-ton truckloads to be taken anywhere.

"Rock and Gravel"

A peculiarity of the producing plants out here is that they are all "rock and gravel" or "rock and sand" operations; never "sand and gravel." Practically all these plants are really just as much rock-crushing plants as any quarry operation, but their rock comes to them in the form of granite boulders, and doesn't have to be quarried. It is a discouraging territory for a quarry man because he obviously cannot quarry his rock and compete in the matter of costs with operators who can pick up loose boulders in gravel pits with steam shovels. The quarry man's only sales argument is quality.

Notwithstanding these conditions the big quarry plant at Corona (described in Rock Products, 1920), now operated by the Blue Diamond Materials Co., is producing to near capacity and is more prosperous than ever before in its history. A big new crushing plant is being built on Catalina Island, about 25 miles from the port of Los Angeles, by Graham Bros., Long Beach, which in many respects will be the most interesting and spectacular rock plant on the coast. It is a side-hill operation of about 4000 tons daily capacity with most unusual storage facilities. We shall print an article about it later on.

The Biggest Plant

The largest organization producing concrete aggregates in Los Angeles is the Union Rock Co., whose plants are all located in railway sidings and whose daily capacity is 15,000 tons. (Some of the plants of this company—those at Azusa and Kincaid—were described in Rock Products in 1920.) Most of the plants are interesting combinations of a straight rock-crushing plant and a sand and gravel screening and washing plant. This company is building between 20 and 30 service bins of several hundred tons capacity each in various strategic parts of the city and is contemplating the construction of a new plant, the largest single unit on the coast, to have a daily capacity of 8000 tons.

The Union Rock Co. is about the only one in Los Angeles at present producing washed sand and gravel in any great volume and it is attempting to capitalize that fact by advertisements in the daily press, of which the accompanying reproduction is a sample. It is given here as a good example of the kind of advertising that undoubtedly would be helpful to the commercial sand and gravel industry in other cities where there is much unfair competition from local pits.

Unwashed Material Used

Under local conditions, however, this argument in favor of washed material lacks much of its customary force because numerous pits do produce material of an excellent quality as verified by tests on concrete made from it. Of course, live operators of non-washed material are meeting the Union Rock Co.'s advertising in this manner—by having tests made and the quality of their material certified to. However, this kind of publicity is undoubtedly very helpful in eliminating much material that should not be used without washing.

I suppose that there are not less than 50 plants regularly producing sand, gravel and crushed rock in the city and its suburbs. These plants have capacities varying from 250 to 1500 yd. per day. Most of the smaller ones are of the cableway excavator type and some are remarkably efficient. I have seen some operations where material was being produced at a total cost, including everything, of around 20 cents per cubic yard. But such operations are, of course, unusual. They do demonstrate, however, that a small efficiently operated plant can compete on equal terms, any day in the week, with the larger plants. The daily production of concrete aggregates in this locality certainly can't be less than 50,000 tons daily, and is very likely near 75,000 tons as some plants operate on two and three shifts night and day.

The conditions described make for the keenest kind of competition and, according to my observation, they have it. There is a good deal of price-cutting, throat-cutting, evidently, in some instances, and little attempt at association or understanding. I am told that sand is sold as low as 25 cents per ton f.o.b. plant and stone around 50 cents. This and the fact that the credit situation is chaotic certainly is a reflection on the boasted business ability of those West Coast business men who happen to be in the aggregate industry, although, of course, many of them realize the need of bettering conditions.

And Still More Plants

Many new aggregate plants are in the air. Every week brings out a new one. A recent rumor is the the Coast Rock and Gravel Co. of San Francisco will start operations in Los Angeles territory soon. With no kind of an association or organization to make a survey of the territory and its possibilities in the way of consuming concrete aggregates, there is apparently no limit to the number of the plants that may be established, because the raw material is everywhere—the only drawback seems to be the rapidly advancing price of the land for city lots.

Lime and Gypsum

All the lime plants in this section seem to be busy. The new plant of the Cajon Limestone Products Co. near San Bernardino is nearing completion and there are rumors of one or two newer ones. It is interesting to note that in a state famed for its production of the precious metal, limestone deposits are now prospected for and explored with all the keenness that the early gold deposits were sought after. I, myself, had the pleasure of taking part in one of these prospecting expeditions last Sunday.

The same applies to gypsum. A deposit near Los Angeles would be the next best thing to an oil find. The Imperial Gypsum Co., with offices in San Diego and a plant in the Imperial valley, is now producing several hundred tons of crude rock per day and shipping it to the new plaster mill of the Blue Diamond Materials Co. at Los Angeles. This fall the Imperial company will build a three-kettle calcining plant of its own. Several other new gypsum plants are in the air, but it is doubtful if there is another deposit of gypsum in the world so extensive, and so easily quarried as that of the Imperial company. They now have a railroad to it and years of trial and labor and expectations are being rewarded. (We shall have an article on this operation in the near future.)

How Long Will It Last?

Los Angeles people have gotten so used

to boom conditions that few of them any longer ask themselves how long such conditions are going to continue or why. It must seem to a conservative visitor that the natives are going wild in the matter of real estate speculation and realty valuations, but certainly no city ever enjoyed a building program such as this city has now and has had for a considerable time. There is all kinds of money for private construction, and the city, the county and the state are liberal spenders for public improvements.

There are many more than a million motor vehicles in California. October 1 a 2-cent tax on gasoline goes into effect which will raise over $9,000,000 per year for road work. Several paved roads already extend from end to end of the state.

In a few years Los Angeles has built itself a harbor out of mud flats and a beach—a harbor whose commerce already is the greatest on the coast, it is said. And already great industries are locating around this harbor. There are oil wells, new ones coming in every day, with capacities of 3000 to 4000 bbl. per day each, almost at the edges of the city and the harbor. There is an immense moving-picture industry, which takes its tribute from every village and hamlet in the United States, if not the world.

Ordinary shop and factory labor, store and office help, etc., is apparently considerably cheaper here than anywhere East. The living conditions are ideal. Rents and living costs are materially less than in the East. There are all kinds of raw materials from cotton to iron ore available. The climate, as you already know, is either "perfect" or "unusual." So what is to stop all the industries in the United States from moving out here? That is about the way the natives reason; and after you have been here awhile you commence to wonder if they may not be partly right.

Plans are maturing for the largest Shope concrete-brick plant in the United States, to have a capacity of 50,000,000 brick a year, which will be located at the gravel pit of G. W. Preston, at La Manda Park, a suburb of Los Angeles. The sales territory includes all Los Angeles and suburbs. The company will be known as the Southern California Shope Brick Co. G. W. Preston is president, Mrs. A. V. Preston is secretary and treasurer and R. W. Clinton is vice-president. Roy Lewis and J. E. Soderholm are directors.

Need for More Research in the Phosphate Industry

THE current *Chem. and Met.* contains an an excellent review of the present methods of making acid phosphate by W. H. Waggaman and H. W. Easterwood, of the U. S. Bureau of Soils. Due praise of the ingenuity of plant engineer and superintendent is given, but the need of research, in order to conserve our natural resources and to make fertilizer more cheaply is pointed out. At present the manufacturers demand the highest grade of rock and penalize heavily the lower grades, with the result that for each ton of *produced* phosphoric acid recovered a ton of phosphoric acid is thrown away in low-grade material or unrecoverable fines. Concluding the writers say:

"The acid phosphate industry in this country is a credit to the ingenuity of the American engineer and to the experience and skill of the factory superintendent. It does not, however, reflect great credit upon the chemist and the conservationist. From the standpoint of water-solubility, mechanical condition and quantity production, acid phosphate has reached a high degree of perfection. Everything considered, it is also produced at a relatively low cost. But from the standpoint of the efficient utilization of our raw materials and the economic handling and shipping of the finished product, acid phosphate does not measure up to the other manufactured fertilizer products.

"We use in this country for fertilizer purposes more than twice as much phosphoric acid as we do of potash and nitrogen compounds, yet the standard carrier of phosphoric acid contains an average of only 16 per cent of P_2O, whereas potash salts contain from 40 to 50 per cent K_2O and manufactured nitrogen compounds such as ammonium sulphate, nitrate of soda and cyanamide contain from 19 to 25 per cent of NH_3.

"Not only does the production of acid phosphate involve immense losses of rock at the mines but the finished product actually contains a lower percentage of fertilized ingredients than the raw material from which it is derived.

"It would seem, therefore, that the widest field for research and the greatest opportunity for advancing the fertilizer industry lies in improving existing methods and devising new and more efficient processes for manufacturing available phosphates."

The Care of Belting

THE *English Quarry Managers' Journal* gives the following excellent advice regarding the care of belting:

To keep belts clean should not be difficult unless they are allowed to have oil or grease splashed on them, and in such cases they should be rubbed dry and clean with a piece of coarse sacking each time the machine stops, and, of course, the pulleys must be scraped as often as they become dirty. At times it becomes necessary to scrape belts also. For this a smooth worn-out, three-cornered file answers well for the purpose.

Leather belts in bad condition should have all loose dirt scraped off, and should be well scrubbed with soft soap in water as hot as the hands can bear, and then wiped and hung up loosely until dry. They should then be dressed lightly on the inside once, and two or three times on the outside rather heavily, with a mixture of one part beeswax melted in three-parts of cod oil, applying this warm, and keeping the belts in a warm place for some days until they have softened through the absorption of the mixture.

After this they should be rubbed dry with a coarse cloth and rolled up until wanted for use. Running belts should have occasional dressing on the outside to keep them pliant.

Textile belts, if kept clean, rarely require any dressing, but at times a light dressing with raw linseed oil will do good.

Generally speaking, there should be little, if any, necessity for using belting syrups or other adhesives is make belts cling to the pulleys, but if used, such compounds should not contain resin. It is always better to use a wider belt and get natural adhesion than to use sticky materials on narrow belts, especially as narrow belts soon wear out when overloaded.

The use of belt dressing is largely a matter of training the men around the pant and off good discipline. Poorly run plants will invariably have pulleys that are heavily coated with dressing, sometimes built up to an inch in thickness. Most well run plants find it possible to do without dressing altogether or to use only that which preserves the belt.

Marking the Gears

REALIZING from past experience that the marking of gears meant the elimination of a great deal of trouble, the William Ganschow Co., Chicago, Ill., has adopted the practice of marking on each gear not only its trade mark, but also a production number upon which the gear was manufactured and the date of its manufacture.

Aside from the convenience which such marking affords in re-ordering, it has the effect of inspiring confidence in the manufacturer, affording the user an accurate means of checking its period of use from the dating which it carries. This company has adopted this method of marking "knowing full well that unless it is to be derogatory to their established reputation, each gear must maintain the Ganschow reputation for quality."

Such a practice could well be followed by others manufacturers, says the company, for it would react favorably for those whose product contained real merit, and would gradually force higher quality among competitors, or cause them to abandon the field because of their inability to meet its standards. As an assistance to the movement for standardization, this system of plainly marking everything should not be underestimated and, if generally followed, it is said, would result in the saving of valuable time, not only on the part of the purchaser, but also in facilitating the rapidity with which orders could be executed in the shop of the manufacturer.

Quarried from Life

By Liman Sandrock

He's a President Eames Once More

THE rock products industry has more than once cradled big men, and here's fresh proof of our assertion: When we opened up our New Haven *Register* of September 15 we were more than pleasurably surprised to see—directly under the first-page scarehead, "Revolution Flames in Spain," and flanked on either side by the news that our friends, the Unitarians, were donating a goodly sum to charity and that Father Walsh was the newly appointed curate—we say, in the midst of all this first-page matter, there appeared this heading:

W. SCOTT EAMES ELECTED
PRESIDENT OF REORGANIZED
SHORE LINE ELECTRIC ROAD

Gentlemen, he's in again—as a president!

It's mighty proud we should be of Brother Eames' elevation to the presidency of a prosperous electric railroad. But, of course, we of the industry know full well his abilities in presidenting things important, for was he not the president of the National Crushed Stone Association last year? So that's that!

You may not know it, but Scott Eames has bulked large in the public eye of his native state of Connecticut for years, not to mention the more or less national reputation he has gained for himself.

We of the industry know him best as the general manager of the New Haven Trap Rock Co., as he so faithfully registers himself at the conventions of the crushed stone folks. What many of us do not know is that he has served in many political offices of trust. For instance, he was for more than five years director of public works in New Haven under the administration of Mayor Frank Rice. And he was an able director.

You know how the mind of the public works when looking for flaws in the public works department of your own home city; it will pick trouble wherever it suspicions it may bob up. But Mr. Eames went out of office solely because his private business interests demanded his undivided attention—and five years is a good measure of service for one faithful citizen in public office.

Versatility is not given to many of us, but it's exemplified in the new president of the electric railroad, for Brother Eames can do a lot of things, and do them well. As a case in point, just suppose you or your Uncle Liman held an interest in the upholstery business, and our partner was a man bearing the name of Savage! Suppose we had to bolster this business up or go to the mattress and take the count. Say, most likely we'd pillow our aching heads on a far from feathery couch and feel very much "overstuffed"—the which is good upholstery lingo and much in the mode, but overstuffing is rank indigestion to us.

But Scott Eames is active in a big up-

W. Scott Eames

holstery concern which is very successful. Some time when you are in New Haven you go see his partner, Mr. Savage (there's nothing really in a name) and he'll tell you just what he thinks of Scott Eames—and do it gladly!

And here's another industry which claims some attention from Mr. Eames, the Totoket Electric Co., in which he holds the money bags in his capacity of treasurer. Of all the corporate offices within our ken, we have always envied that of the treasurer. Even if he has his bad quarter-hours in making both ends get together, at least he has the satisfaction of holding money in his temporary custody; he attains a close intimacy with old man Dollar that is denied us office fellers and field chaps. Mr. Treasurer at least knows what a fairly respectable wad looks like.

In his new capacity as president of the New Haven and Shore Line Electric railroad, Mr. Eames will have fine opportunities to exercise his keen business acumen and his wide experience as an executive. It's a prosperous railroad operating between New Haven and Saybrook and has developed a good passenger and freight business, adding new equipment to meet the traffic that is coming to it daily.

Mr. Eames' associates are also men of wide experience in business and the engineering professions. Vice-President Sperry is the head of the Sperry Engineering Co., which has built and operated some fine properties. Treasurer Kingston is well known in financial circles. Director Blakeslee is also associated with Mr. Eames in the New Haven Trap Rock Co., and the board of directors numbers other able men who have chosen Mr. Eames as their president.

Several columns of the *Register* are devoted to our brother telling of his business interests and accomplishments and declaring its faith in him. We only wish we had the space to recount all that this paper has said.

In conclusion, however, we want you to know that Mr. Eames is as well thought of politically, socially, and fraternally as we have always regarded him in our association with him, particularly at the conventions, at which he is always a faithful attendant.

He is one of the founders of the West Haven Republican League; is a member of the Union League Club; is prominent in Masonic circles and other fraternal bodies; is a trustee of the First Methodist church, and—well, what more can we say of any other man in the rock products industry. It's a big and fine record. We are main proud of him and wish him the success that he will undoubtedly attain.

Soapstone Quarry Opened in North Carolina

A $200,000 company has been organized in Winston-Salem, N. C., according to the *Journal*, published in that city, to develop a large deposit of soapstone in Ashe county, North Carolina. W. G. Jones is president; D. P. Sites, vice-president, and C. R. Willams, secretary and treasurer. The vein is 3000 ft. long and 300 ft. wide and is being equipped with thoroughly modern equipment. Steel frame buildings will house the sawing and shaping machinery.

Soapstone is used, among other things, for electrical purposes and the sales manager of the company says that the General Electric Co. wishes to contract for the entire output.

The company has already begun the manufacture and delivery of soapstone disks for use with fireless cookers, of which thousands are in use in the United States. Soapstone for these has been imported from European countries.

Editorial Comment

Coal and Rock Products

The coal industry and the rock products industries seem to be inextricably mixed, not so much because these industries are large users of coal, as because they all use the same kind of freight cars. At present, in times of car shortage, coal shipments are decidedly favored. This may be good policy from the point of view of the man whose coal bin is low, but it doesn't help the contractor who is held up for a car of crushed rock or sand and gravel to know that his neighbor is getting coal. As we understand the position of the industries this paper represents, they ask no special favors; they only want coal put on the same basis as other industries. If this were done, and the public were given to understand that coal shipments were to receive no priority, it might go far toward curing one evil of the coal business, which is to wait until the season is far advanced before buying coal, so that everyone wants his coal delivered at the same time.

The Coal Situation

Some newspapers are saying that Gov. Pinchot's settlement of the anthracite strike has made him so popular that he will be a strong presidential candidate. Others are pointing out that the public is chiefly interested in the $1 a ton that is to be added to the price, as the cost of avoiding the strike. The man in the street is not satisfied as anyone may prove for himself by listening in on the conversation in any street car or railroad train. The coal situation seems to be a popular subject for discussion today. Engineering and scientific bodies all over the country are making investigations and it is quite possible that the coal business will be controlled by a commission, in the same way that the railroads are controlled by the Interstate Commerce Commission.

Miners Control the Work

A well known coal mining engineer, Mr. Thos. A. Stroup, points out that the fundamental difficulty of coal mining is in the control of the work. At present this control is in the hands of the miners themselves who hold this control by reason of their special knowledge and who are enabled by licenses and other restrictive laws to form themselves into a close combination. The same state of things formerly existed in metal mines, but now all work in them is standardized and directed by engineers who not only direct all the operations but take all the responsibility. As in all industries where control comes from a single source, the men are more efficient and more contented, and the causes of friction with the management have largely disappeared. It is prophesied that this will be the case in coal mining when the control passes from "this group of skilled workers, insanely jealous of their special knowledge, and easily maintained in compact units" into the hands of engineers who will standardize the work and direct all operations. Organization and direction from a single source are the two pillars by which modern industry is supported.

Geology of Rock Products

It is to be hoped that none of the readers of ROCK PRODUCTS overlooked the interesting "Geology of Glass Sands," by H. W. Elkinton, in the last issue. Miners and oil drillers have long recognized the value of geology in their work. Its value in the working of gravel pits and stone quarries is not so fully recognized. Yet in many cases a little geological information would have saved investors a lot of money. Instances that come to one's mind are, the development of a limestone "quarry" in a locality of which the geology was well known and in which it was impossible to suppose that anything more than thin sheets of limestone in a body of worthless shale could exist. Another is the start of a dredging operation in a gravel deposit which, according to the geology of the district, could not contain sufficient water to float a dredge, in spite of surface appearances.

Value of Our Resources

Geology too will give us a better understanding and appreciation of our own rock products resources. At present, we are accustomed to refer to them as "inexhaustible," but in this new industrial world of ours nothing is inexhaustible. Sand and gravel exist in tremendous quantities but workable sand and gravel deposits near enough to market to permit of cheap transportation already show signs of scarcity in some localities. There are large areas of the United States in which good rock to crush into aggregate exists only in thin beds that cannot be worked by the best methods. As an example of the other sort, what a good supply of raw material may mean to a city is well illustrated in El Paso, Texas. The city is literally built from the mountain of limestone nearby, and the mountain not only supplies buildings but a livelihood to many of the inhabitants who work in the many lime and crushed stone quarries and the big portland cement plant for which the city is noted.

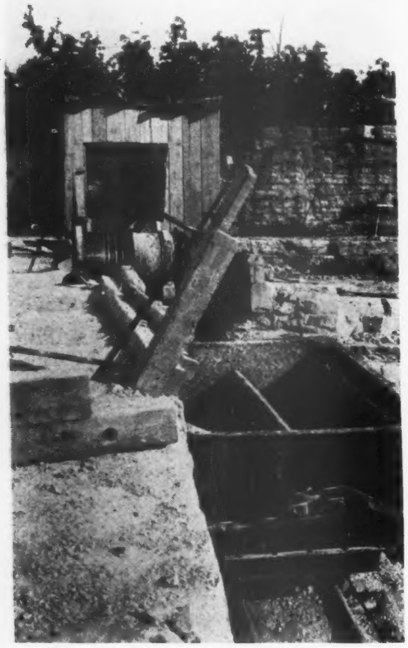
Also one of the reasons for the phenomenal growth of Los Angeles may be found in its abundant rock products resources.

Hints and Helps for Superintendents

An Inclined Tramway at a Lime Quarry

GRAVITY offers the cheapest possible source of power in the fortunate instances in which it can be applied. The inclined plane or gravity tramway is an application of this principle that is seldom overlooked by quarry men, so there is nothing particularly novel about the installation which is shown here. But it is worth a little study, as it is a simple and very efficient installation. The first view shows the hoist and the shelter for the hoistman and the type of car employed. The car is below level so that it may be filled by dumping from a wagon as shown in the left hand cut below. The foot of the tramway, or receiving end, is shown on the other side of the page. The car runs over the hopper of the crusher and is dumped there. The type of hoist is shown in the right hand cut at the bottom of the page, a simple two-drum hoist.

WE will pay $2 for every photograph or sketch that we can use in this department—and you don't have to be an artist to make a sketch that will get the $2. Anything so that it is clear enough to understand. It may be as simple as a new knot in a rope or as complicated as a new plant layout, just so long as it is different from the ordinary way of doing things and helpful. Every plant in the world has material for this page and a little hunting will find it.

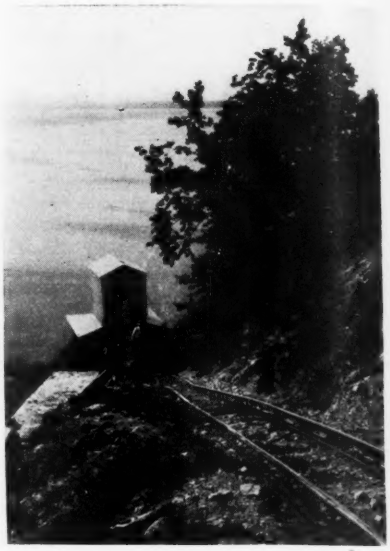


The bottom-dump car and two-drum hoist

Steam, gasoline and electric driven hoists are used for this purpose. Most operators prefer to use steam with a coal fired burner, especially if they are "old timers" and used to a steam hoist. But the hoist with internal combustion engine has been developed to a point where it is quite as reliable and easier to run than a steam hoist and it is certainly much less expensive to operate.

Electric drive is better than either of these, especially where a man is not kept at the hoist all of the time.

Passing of the cars is provided for by a turnout with fixed switches. If this is properly put in the cars may pass at a fairly high rate of speed, but if it is not it is always a source of trouble from cars jumping the track.

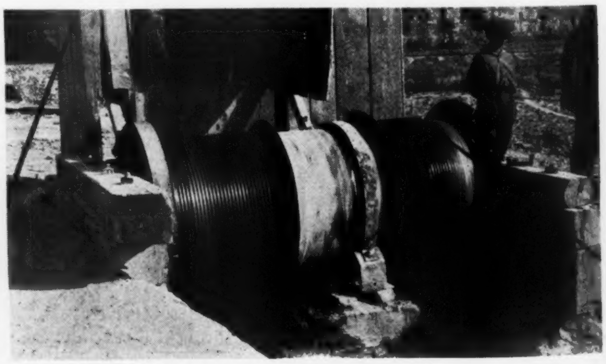


Foot of tramway, showing how car comes to the plant

Of course the loaded car pulls the empty car back to the head of the tramway.

A German invention makes it possibe for a tramway to *lift* instead of lower a load, but this is really an application of water power. The loaded car at the foot of the tramway is counterbalanced by a tank of water. Water is run into the tank until there is weight enough to pull the loaded car up. The water is emptied from the tank at the bottom, and as the empty car weighs more than the tank, it will pull it up to the head of the tramway.

This arrangement is used on a short passenger line, and it has also been used for lifting rock and ore. A small flow of water running into an auxiliary tank will do the work, as the auxiliary tank can fill the running tank very quickly.

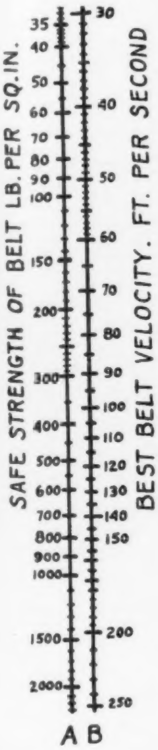


Left, head of the tramway, showing hoist and operator with wagon ready to load car. Right, a close-up of the hoist employed. The pictures are from the Western Lime and Cement Co.'s quarry

The Best Speed for a Belt

By W. F. Schaphorst*

THERE is no question that centrifugal force will "explode" any belt, if the speed of the belt is enough.



I have figured, for instance, that a leather belt of 1000 lb. breaking strength per square inch will explode without pulling an ounce of load when running a trifle over three miles per minute.

It is evident, then, that three miles per minute is too fast. No use running a belt and pulleys at that speed if they refuse to do anything but tear themselves to pieces.

Also, a belt won't do anything when it isn't moving—when its velocity is zero.

Therefore, somewhere between zero velocity and three miles per minute there is a "best belt speed," and at that speed the belt will transmit the most power.

This chart gives the best speed for any leather belt of known safe strength.

Find the safe strength of the belt in column A. Column B will then give the best velocity. All you need do is—glance across from column A to column B.

For example, if the safe strength is 200 lb. per square inch (which would be a second class leather belt), the best velocity is 74 ft. per second.

Since cotton and canvas belts often weigh the same per cubic inch as leather belts, this chart is equally applicable to such equal weight belts.

It is assumed here that the belt is not subject to needless initial tension in addition to the tension of centrifugal force and the load tension on the tight side. If initial tension is practiced it is difficult to tell just what the best speed would be, because such practice sometimes breaks belts even before they do any work at all. Certainly, high initial tension reduces the best speed to a much lower figure than given in this chart.

This chart, therefore, should prove to be an important aid in the selection of belts and pulleys. It shows clearly the advantages of strong belts, and high speed means high power. It shows that new strong belts should be run at high speed. As they grow older and weaker they can be used on slower drives.

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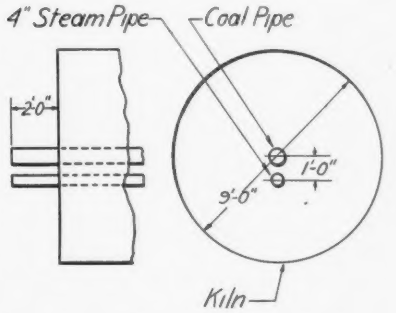
Steam Aids Lime Burning

LIME burning, as has been pointed out by ROCK PRODUCTS on several occasions, is materially assisted by injecting steam into the kiln.

The Campbell Stone Co., Indian River, Mich., burn lime in a rotary kiln, 9x115 ft., using powdered coal. At the beginning of this operation, producer gas was used, the pulverized coal system being later installed to increase the production. It was found however that with powdered coal considerable unburned coal dust accumulated in the dust chamber.



Adding steam to a lime kiln

When a steam jet, discharging through a 4-in. steam pipe slightly bent into a nozzle, was inserted about 2 ft. into the kiln and discharging steam at 125 lb. pressure, combustion was complete, no coal being deposited in the dust settling chamber.

An appreciable saving of coal resulted as well as somewhat increased production.

A valve is inserted in the steam line by which the flow of steam is regulated according to the experience of the operator.

Tube Mills Lined with Rubber

RUBBER, ⅝-in. thick and equivalent in softness and quality to the material of which the tread of a good cord tire is made, has been successfully used for lining a tube mill at the Nipissing mine in Ontario, Canada. Tests on this lining are described in the current *Engineering and Mining Journal-Press,* by Arthur Parsons, assistant editor. In conclusion he says:

(1) The cost of the material in a new set of ⅝-in. rubber liners is somewhat less than that of a set made of iron 2 in. thick.

(2) The weight of a set of rubber liners is about 1-20 that of a new set made of iron. This would be a decided advantage where freight rates are high.

(3) The life of a set of rubber liners will, of course, depend on the thickness. However, it is safe to say that a ⅝-in rubber liner on material under 4-mesh will last at least as long and probably much longer than a 2-in. iron liner. On this basis the cost per ton of ore crushed would be appreciably less than for iron.

(4) The mechanical work of installing or replacing rubber liners is trifling compared with the same cost for iron. The time required for replacement would be shorter, thereby reducing the period of shutdown for renewals.

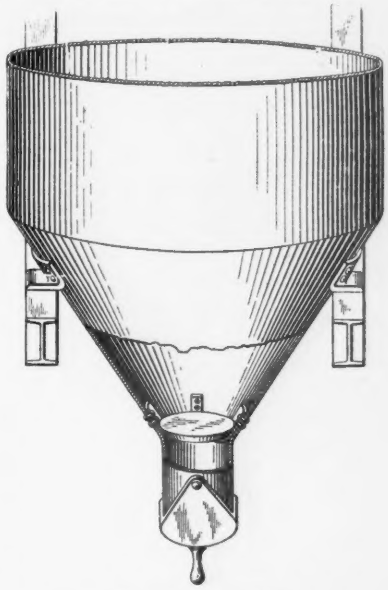
(5) A rubber-lined mill operating at capacity will require slightly more power than the same mill lined with iron, for the reason that the balls are raised higher. However, the consumption of power per unit of effective crushing done will be much less.

(6) The ball consumption is less with rubber than with iron liners because the wasteful wear between balls and liners is eliminated.

(7) The grinding capacity of mill lined with rubber is much greater than that of the same mill lined with iron. That means economy in intial investment for equipment, in mill space, in operating and maintenance expenditure. It means decreased cost per unit of effective work done.

Bin That Will Not "Pipe"

THE cut, from *Chemical and Metallurgical Engineering* shows a bin for holding dry, pulverized substances that is said not to "pipe." By piping is meant the formation of a circular channel down which the material passes, leaving the greater part of the binfull adhering to the sides.



A non-piping bin

The idea is old as applied to wet material, in the so-called Caldecott Cone. This is the first publication noted of the application of a diaphragm to a bin for dry material. This diaphragm or "baffle" is clearly shown at the bottom of the bin, where the side is shown as broken away. The function of the baffle, according to one theory, is to maintain a small cone on its upper surface, and this cone acts to deflect the material toward the sides thus preventing a straight downward flow and the formation of a central channel.

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert,
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning October 1:

Illinois Freight Association

2050. Phosphate of Lime, carloads, 36 cents per 100 lb. from Hoopeston and Chicago Heights, Ill., to Sikeston, Mo.

2095. Molding Sand, carloads, minimum weight 90 per cent of marked capacity of car, must not be less than 40,000 lb., $1.15 per net ton from Ritchie, Ill., to Rockford, Ill.

1867. Stone, Sand and Gravel, C. L., minimum weight 90 per cent of marked capacity, $1.18 per net ton from Joliet, Ill., to Gillum, Downs, LeRoy, Farmer City, Mansfield, Rising and Champaign, Ill., and $1.06 per net ton on sand and gravel, C. L., same minimum weight from Lincoln, Ill., to Leslie, Tremont, Menert, Mackinaw, Lilly, Woodruff and Danvers, Ill.

Central Freight Association

7147. Molding Sand, Marine City, Mich., to Michigan:

	Pres. rate Cts. per cwt.	Pro. rate Cts. per ton
Ann Arbor	16	$1.55
Adrian	17½	1.64
Albion	19	1.65
Dowagiac	22½	2.00
Hillsdale	19½	1.76
Marshall	19½	1.76
Milan	16	1.55
Wyandotte	14	1.55

7150. Stone, Rip Rap, Bedford-Bloomington district to New Orleans, La. Present, Class A rates of 56½ cents via certain routes and 58½ cents via other routes. Proposed, $3.28 per net ton, minimum weight marked capacity of car, except when car is loaded to full visible cubical capacity, actual weight will govern, but in no case will minimum weight be less than 40,000 lb.

7163. Crushed Stone, Marble Cliff and Sullivant, Ohio, to Hookers, Ohio. Present, 80 cents per net ton; proposed, 70 cents per net ton.

7172. Sand, common building, glass or molding, Ashland, Ky., etc., to Benton Harbor, Mich.:

(In cents per net ton)

From Group 1	From Group 2
Ashland, Ky.	Lawton, Ky.
Augusta, Ky.	Limestown, Ky.
Ausanba, Ky.	Olive Hill, Ky.
Mentor, Ky.	Tygart, Ky.
Present $3.15	$3.27
Proposed 2.65	2.77

New England Freight Association

5247. Crushed Stone, Burlington, Vt., to St. Albans, Vt., $1 per net ton. Reason: Rate comparable with other rates in New England.

5271. Lime, minimum weight 50,000 lb., Canaan, New Milford, West Stockbridge, Mass., and other Berkshire producing points to Hackensack, N. J., 17 cents per net ton. Reason: To permit movement of traffic.

Southern Freight Association

11183. Rough Quarried Stone, C. L., from Neverson, N. C., to Ohio and upper Mississippi river crossings, points in Central Freight Association and Illinois Freight Association territories and points in Iowa and Canada. Class or combination rates now apply. Proposed rates: Same as published by Southern railway from Granite Quarry and Mt. Airy, N. C.

11184. Rough Quarried Stone, C. L., from Neverson, N. C., to Eastern, interior Eastern, New England points and Buffalo-Pittsburgh territory. Class rates apply at present. Proposed rates: Same as published by Southern railway from Granite Quarry and Mt. Airy, N. C.

11193. Cement, C. L., from Birmingham and Leeds, Ala., to Lanes, S. C., Buffalo-Union Carolina railway stations and S. A. L. railway stations between Lanes and Georgetown, S. C. Where through rates are published they are shown in Agent Glenn's Cement Tariff. It is proposed to establish same rates as in effect from Ragland, Ala., and which are usually the same as from Richard City, Tenn. Proposed rates represent reductions.

11194. Stone, crushed, C. L., minimum weight marked capacity of car, Ladds, Ga., to Dubose, S. C. (S. A. L. railway). No commodity rate at present in effect. Proposed rate, $2.12 per net ton, made on basis of proposed Georgia scale, less 10 per cent.

11216. Cement, C. L., from Birmingham, Ala., and group, Leeds and Ragland, Ala., to Atlantic Coast Line railroad local stations between Lanes and Sumter, S. C. Present rates: From Birmingham, Ala., 31½ cents per 100 lb. to all stations involved; from Leeds and Ragland to Manning, 23 cents; lowest combination to other stations. Proposed rate, 23½ cents per 100 lb., same as present rate from Leeds and Ragland, Ala., to A. C. L. railroad stations Harvin to Carolina Lumber Co., inclusive.

11218. Lime, C. L., from Knoxville, Tenn., to Irvine, Jackson and Whitesburg, Ky. Class "N" rates apply at present. Proposed rates: To Irvine, $2.60; Jackson, $3.10; Whitesburg, $3.40 per net ton. The proposed rates are constructed on basis customarily observed by the L. & N. railroad in aligning rates to points in the same territory.

11223. Crushed Stone, C. L., minimum weight 90 per cent of marked capacity of car from Klotz, Va., to Bryan, N. C., Grimesland, N. C., and Simpson, N. C. Present rate $2.50 per net ton (combination). Proposed rate, $2 per net ton.

11245. Gypsum Rock, C. L., minimum weight 60,000 lb., from Saltville and Plasterco, Va., to points named below. Present and proposed rates are, in cents, per 100 lb.:

To	Present	Proposed
Chattanooga, Tenn.	$.15	$.12½
Richard City, Tenn.	.18½	.13½
Nashville, Tenn.	.17½	.13½
Birmingham, Ala.	.16	.13½
Leeds, Ala.	.16	.13½
North Birmingham, Ala.	.16	.13½

Proposed rates are for the purpose of meeting competition at other shipping points, particularly in Oklahoma.

11246. Gypsum Rock, C. L., minimum weight 60,000 lb., from Saltville and Plasterco, Va., to Ainslie and Coreen, Ga. Class rates apply at present. Proposed rate, 19½ cents per 100 lb., same as in effect to Macon, Ga.

11262. Cement, C. L., from Birmingham and North Birmingham, Ala., to A. & W. P. railroad and F. R. & N. E. railroad stations. It is proposed to establish rates to A. & W. P. railroad stations the same as from Leeds, Ala., and to cancel through rates to Flint River & Northeastern railroad stations, leaving lowest combination to apply which will produce lower rates.

11289. Cement, C. L., from Portland and Rockmart, Ga., to Elton and Byram, Miss. (for I. C. railroad delivery). Present rate, 17 cents per 100 lb., which is result of typographical error made in tariff publication. Proposed rate, 19 cents per 100 lb., which is the correct figure, and which will also eliminate existing fourth section violations.

11294. Sand, building, common and molding, C. L., minimum weight 40,000 lb., from Eastern pits of origin shown as taking Rate Basis No. 2, pages A9 to A85, of Agent Cottrell's Eastern Cities-Carolina Trf., I. C. C. 448, to Lincolnton, N. C. Present rate, $6.24 per net ton (Gastonia, N. C., combination). Proposed rate, $5.65 per net ton, same as applicable to Gastonia, N. C., and other Carolina destinations.

11301. Limestone, ground or pulverized, C. L., minimum weight 60,000 lb., from Whitestone, Ga., to Britton, Dalzell and Mayesville, S. C. Lowest combination now applies. Proposed rate, $2.37 per net ton, same as in effect from Mascot, Tenn.

11318. Stone, crushed, C. L., minimum weight marked capacity of car, from Ladds, Ga., to Mayesville, S. C. (A. C. L. railroad). No commodity rate at present in effect. Proposed rate, $2.25 per net ton.

Southwestern Freight Bureau

9525. Cement. To establish rate of 17 cents per 100 lb. on cement, C. L., as described in Mo. Pac. R. R. Trf. 1399F, from Kansas producing points named in this tariff to stations on the Midland Valley railroad in Oklahoma shown below: Hardy, Frankfort, Grainola, Foraker, Blackland, Pearsonia, Meyers, Pawhuska, Mahon, Tallant, Barnsdall, Nichols, Avant, Bradshaw, Skiatook, Baltic, Benson, Rotary, Sperry, Turley, Edgar, Nirine, Jenks, Bixby, Leonard, Stone Bluff, Haskell, Yahola, Taft and Pecan.

9538. Stone, rough or sawed not further finished. To establish rate of 13 cents per 100 lb. on stone, rough or sawed not further finished. Carload minimum weight 50,000 lb. (will not apply on crushed stone, broken stone ranging in size up to 200 lb.), from Batesville, Ark., to Carthage, Mo. Remarks: The proposed rate of 13 cents compares favorably with the rates published to points beyond; for example, the rate of 20½ cents to Missouri river and rate of 10 cents from Cartney, Ark.

9569. Emergency. Asphalt Coated Stone, Sand or Gravel. To establish rates on asphalt coated stone, sand or gravel, minimum weight marked capacity of car used, except where cars are loaded to full visible space carrying capacity in which actual weight will govern, from Sandune, Texas, to Rock Island, Mo. Pac., L. & P., K. & N. W. and T. & P. railways on basis of 2 cents higher than the single line rate published on sand and gravel in Item 1750 of Texas Lines' 2H. Remarks: This commodity consists of gravel, sand or stone with approximately 12 per cent asphalt, and it is contended proposed basis will make proper rates on this asphalt treated traffic.

9578. Stone and Granite (rough quarried). To establish through rate of $6.88 per net ton on stone and granite (rough quarried), carloads, from Ethridge, Oglesby and Elberton, Ga., to Texas common points.

9579. Cement Plaster. To amend Item 1035 S. W. L. Trf. 3D, applying on cement plaster, etc., between points in Southwestern Freight Bureau territory to provide that switching charges, if any, will be in addition to the through rate and stopover charge; or amend the item to specifically provide as to how the switching charges will be disposed of. Remarks: The proposed change is claimed necessary to show clearly application of switching charges in connection with stopover privileges on this traffic.

9581. Cement. To amend Trf. 90D, applying on cement, etc., carloads (stopping in transit for partial unloading), from points of origin named in S. W. L. Trf. 90D to points of destination named in that tariff, making it subject to S. W. L. Classification Exceptions No. 3N. Remarks: Request is received to permit stopping in transit of shipments of cement, etc., moving under Trf. 90D, the same as is now authorized in W. T. L. Trfs. 132 and 133, and as also permitted locally in Oklahoma.

9599. Cement. To establish through rate on cement, C. L., from Mankato, Minn., to Arkansas, Louisiana, etc., named in S. W. L. Tariff 90D based 15 cents per 100 lb. over the rate from Kansas City, or 17 cents per 100 lb. over the rate from St. Louis, to points of destination in S. W. L. Tariff 90 D, whichever is lower. Remarks: The proposed change will have the effect of establishing through rates from Mankato, Minn., the same as were in effect prior to the cancellation of the same clause.

9603 (emergency). Cement. To establish rate of 14½ cents per 100 lb. on cement, C. L., from stations on the Missouri-Kansas-Texas railroad in Kansas to Kiefer and Mounds, Okla., on the Oklahoma Union railway. Remarks: It is proposed to publish to, from and between points on this extension and state and interstate points the same rates, minimum weights, rules, regulations, etc., as are now in effect to, from and between these points via other lines. Through rates are now in effect to, from and between other points on the Oklahoma Union railway, and there is no reason why similar arrangements should not be made to cover the additional points.

9623 (emergency). Cement Plaster and articles taking same rates. To establish rate of 18½ cents per 100 lb. on cement plaster, C. L., and articles taking same rates from Texas producing points to Kiefer and Mounds, Okla., on the Oklahoma Union Ry. Co., same as in effect via other lines. Remarks: See 9603—emergency.

At the request of some producing interests of the West, a meeting of the Western Tariff Congress was held in Denver, Colo., October 3 and 4.

To License Cement Block Makers

AN ordinance licensing concrete block manufacturers, giving the Evansville, Ind., building inspector power to revoke licenses where the manufacturers fail to comply with the specifications outlined, will be proposed by Building Inspector Kerth, who announced his intention of proposing such an ordinance at a meeting of concrete block manufacturers and representatives of the portland cement manufacturers of Chicago.

The ordinance will specify that all concrete blocks for building purposes have a minimum compression strength of not less than 750 lb. to the square inch and must meet the proper absorption tests. No composition or ingredients are specified in the proposed ordinance, it being taken for granted that a sufficient amount of cement will be necessary to obtain the required compression strength.

A license fee of $50 a year will be levied on the manufacturing plants, the license fee to include the cost of making tests during the year. The proposed ordinance also provides that each manufacturer shall make his block in such a manner that it may be identified. The latter section of the ordinance, Inspector Kerth told the manufacturers, was inserted for protection to the manufacturer in the event of a contractor securing a building permit with the intention of using concrete blocks not approved by the building department.

"We will post an approved list in our office and no buildings may be erected with blocks made by manufacturers whose names are not on our approved list," Inspector Kerth said.

The ordinance provides that buildings built of concrete blocks must be not more than 40 ft. in height, and that a solid footing must be placed as a foundation.

At the meeting several blocks of inferior grade were exhibited by the building inspector. One of the blocks in particular was said to be composed of about two ounces of cement, the rest being sand and other ingredients used to make it of sufficient size. A bottle of water poured on the surface of the block was absorbed instantly without leaving a trace.

Los Angeles Firm Sells Concrete Ready to Pour Into Forms

LOS ANGELES' first portland cement concrete-mixing plant—in fact, the first in the West—will be in operation soon, prepared to deliver right on the job any amount of concrete necessary for the task at hand, whether it be the laying of a strip of sidewalk by a householder or the erection of a huge warehouse by a big contractor.

The new plant is owned by Stine & Ellis, and is situated at La Brea and Santa Monica boulevards. It cost more than $100,000, and has a capacity of 365 yd. of mixed concrete every eight hours. The equipment consists of four huge rock hoppers, two sand hoppers, a nine-sack batch Smith tilting mixer, conveyors for sand and stone and a fleet of delivery vehicles ranging from the lightest of auto vans to immense dump trucks. All machinery is electrically driven, and two 15- and one 30-hp. motors are on the job to supply the current.

The Stine & Ellis system, it is claimed, will eliminate all trouble with waste. No matter how small or how large the task in hand, the mixed concrete necessary can be delivered right to the job at the very minute it is needed. It is also stated that a material saving can be effected regardless of the quantity used, as the modern plant of the company eliminates "overhead" to a marked degree.

On larger jobs, it is pointed out that there will be no waste on the subgrade, such as is the case when the materials are dumped by the roadside and later shoveled into the mixer. Ready-mixed concrete, it is claimed, will insure against any foreign materials entering into the concrete when it is finally laid.

Prof. Abrams Studying Effect of Alkali on Concrete

PROFESSOR DUFF A. ABRAMS of the Lewis Institute, Chicago, an eminent authority on cement and concrete, left recently for San Francisco after spending a few days in Utah. He was met at Huntington, Utah, in company with Professor G. M. Williams, of the University of Saskatchewan, Canada, and Irving Furlong, of the San Francisco office of the United States Bureau of Standards. There they observed the effects of alkali salts on concrete tile placed in 1913.

The party inspected bad stretches of the concrete road between Salt Lake and Ogden. —*Salt Lake City Tribune.*

Texas Sand and Gravel Production $1,730,046

STATISTICS showing the production of sand and gravel in the state of Texas in 1922 have just been compiled by the Bureau of Economic Geology of the University of Texas, in co-operation with the United States Geogical Survey. Dr. J. A. Udden, director of the Bureau of Economic Geology, has given them out as follows:

Glass sand (for melting only), 21,146 short tons, valued at $4146; molding sand (including pigbed sand, steel, brass, iron and cores, 1275 short tons, worth $2445; building sand (concrete and mortar), 448,956 short tons, worth $323,517; cutting and grinding sand, 728 short tons, valued at $582; engine sand, 12,605 short tons, worth $9291; paving or road making gravel, 661,175 short tons, valued at $366,043; railroad ballast, 880,707 short tons, valued at $307,655. The total is estimated as to quantity as 2,939,103 short tons, and the total value as $1,730,046.—*Houston Press.*

Investigating the Coal Problem

THE Federated American Engineering Societies sends out the following from its New York office:

America's coal problem will be brought before the engineers of the nation at Rochester, N. Y., October 12 and 13, when, it is announced by President Mortimer E. Cooley, the Executive Board of the American Engineering Council of the Federated American Engineering Societies will convene for a discussion of pressing social, industrial and scientific questions.

Of chief interest will be a report of the Federation's Committee on Coal Storage, which has been conducting a study in cooperation with 107 local committees all over the country. Characterizing the investigation, a statement by the federation declared that the engineers "are not viewing the storage of coal as a practice which should be adopted on any basis other than that of sound economic judgment."

Of the difficulties encountered by the investigators, the statement added:

"It has become apparent that the entire United States cannot be treated as a single unit in an investigation of this kind. Industrial and transportation conditions vary so greatly in different parts of the country that activities must be grouped in accordance with territorial divisions."

The opinions and advice of engineering committees located in many parts of the country are being sought, and the report will contain many expressions from these groups. In its final form, the report is bound to reflect the judgment of the engineering profession at large.

Wilmington (N. C.) Concrete Products Co. Sells All Over World

IS Wilmington a manufacturing city? Ask the 50 men working for the Cement Products Co. on South Front street and see what they think. This concern is only about nine years old and yet its products go all over the world. It has customers in Japan and even in Africa. It has sold its concrete septic tanks to 30,000 school houses.

It makes 12,000 concrete brick a day when running full time or 60,000 a week, for it works only five days.

It builds concrete culverts, sewer, pipe and storm sewers and supplies state highways, railroads and municipalities. Also its pipes are used in many of the South's drainage projects.

The sand it uses comes from Hamlet, N. C., and Petersburg, Va.

Business this year is all that could be desired with big fall demand indicated.—*Wilmington, N. C., Star.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.40	1.40	1.30	1.10	....
Buffalo, N. Y.			1.30 per net ton all sizes			
Chaumont, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Cobleskill, N. Y.	1.25	**1.25**	**1.25**	**1.25**	**1.25**	———
Coldwater, N. Y.			1.50 per net ton all sizes			
Eastern Pennsylvania	1.35	1.35	1.45	1.35	1.35	1.35
Munns, N. Y.	1.00	1.40	1.40	1.30	1.30	....
Prospect, N. Y.	.80	1.40	1.40	1.30	1.30	....
Walford, Pa.	1.55	1.55	1.55	1.55	1.55	1.55
Watertown, N. Y.	.50	....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.75	....	1.50	1.35	....	....
Buffalo, Iowa	.90	....	1.35	1.15	1.20	1.20
Bloomville, Middlepoint, Dunkirk, Bellevue, Ohio	1.00	1.10	1.10	1.00	1.00	1.00
Chasco, Ill.	1.35	1.35	1.35	1.35	1.35	1.00
Chicago, Ill.	.80	1.40	1.10	1.10	1.10	1.10
Dundas, Ont.	.90	1.35	1.35	1.25	1.10	1.10
Greencastle, Ind.	1.25	1.15	1.05	.95	.95	.95
Krause, Columbia and Valmeyer, Ill.	1.20	1.20	1.35	1.35	1.20	1.20
Lannon, Wis.	.80	1.10	1.10	1.00	1.00	.90
Mitchell, Ind.	1.00	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.90	1.20	1.10	1.00	.95	.95
Montrose, Iowa	....	1.50	1.60	1.55	1.45	1.40
Sheboygan, Wis.	1.05@1.10	1.05@1.10	1.05@1.10	1.05@1.10	1.05@1.10	1.05@1.10
Southern Illinois	1.35	1.35	1.35	1.35	1.35	1.00
Stolle, Ill. (I. C. R. R.)	1.30	....	1.35	1.35	1.35	1.35
Stone City, Ia.	.75	....	1.50†	1.40	1.30	....
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25‡	2.25‡	2.25‡	2.00	2.00
Waukesha, Wis.	1.00	1.00	1.00	1.00	1.00	1.00
SOUTHERN:						
Alderson, W. Va.	.75	1.25	1.40	1.25	1.15	....
Bridgeport, Texas	1.10	1.40	1.35	1.35	1.25	1.25
Cartersville, Ga.	....	1.50	1.50	1.00	1.00	1.00
Chickamauga, Tenn.	.85@1.00	1.00@1.25	.85@1.25	.85@1.25	.85@1.25	....
El Paso, Texas	1.00	1.00	1.00	1.00	....	———
Ft. Springs, W. Va.	.40	1.75	1.75	1.60	1.40	....
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	....
Ladds, Ga.	....	....	1.40	1.40	1.40	....
Morris Spur (near Ft. Worth), Tex.	1.10	1.35	1.30	1.25	1.25	1.20
WESTERN:						
Atchison, Kans.	.50	2.10	2.10	2.10	2.10	1.60‡@2.00
Blue Spr'gs and Wymore, Neb.	.20	1.45	1.40	1.35	1.25	1.20
Cape Girardeau, Mo.	1.35	....	1.10	1.35	1.10	....
Kansas City, Mo.	1.00	1.65	1.65	1.65	1.65	1.65

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.50	1.35	1.15	1.00	....
Dresser Jct., Wis.	1.00	2.25	....	1.75	2.00	....
Duluth, Minn.	1.00	2.25	2.00	1.50	1.40	....
E. Summit, N. J.	1.80	2.30	1.90	1.60	1.40	....
Eastern Massachusetts	.85	1.75	1.75	1.40	1.40	1.40
Eastern New York	.75	1.50	1.50	1.30	1.40	1.30
Eastern Pennsylvania	1.25	1.55	1.50	1.40	1.40	1.40
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.50@2.00	1.35@1.50	1.15@1.25	1.00@1.10	....
Oakland, Calif.	1.75*	1.75*	1.75*	1.75*	1.75*	1.75*
Richmond, Calif.	.75*	....	1.50*	1.50*	1.50*	....
San Diego, Calif.	1.80	1.80	1.50@1.80	1.25@1.55	1.25@1.55	1.10@1.35
Spring Valley, Calif.	.70	1.55	1.50	1.40	1.35	1.35
Springfield, N. J.	1.60	2.10	1.90	1.70	1.60	1.60
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Atlanta, Ga.—Granite	1.47	2.07	2.07	1.97	1.97	....
Buffalo, N. Y.—Granite	.90	....	1.20	1.00	1.05	1.10
Berlin, Utley and Red Granite, Wis.	1.60	1.70	1.60	1.50	1.40	....
Columbia, S. C.—Granite	.50	2.25	2.25	2.00	2.00	2.00
Eastern Penna.—Sandstone	.85	1.60	1.55	1.35	1.35	1.30
Eastern Penna.—Quartzite	1.20	1.35	1.20	1.20	1.20	1.20
Lithonia, Ga.—Granite	.75	1.75	1.75	1.25	1.25	....
Los Angeles, Calif.	2.00	2.00	1.85	1.75	1.65	....
Middlebrook, Mo.—Granite	3.50@3.75	....	2.00@2.25	2.00@2.25	....	1.25@1.50
Sioux Falls, S. D.—Granite	1.00	1.60	1.55	....	1.50	....

*Cubic yd. †1 in. and less; ‡prices include 90c freight.

Agricultural Limestone

(Pulverized)

Chaumont, N. Y.—Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$—Thru 100 mesh; sacks, 4.00; bulk	2.50
Grove City, Pa.—Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$; 60% thru 100 mesh; 45% thru 200 mesh; 100% thru 20 mesh; sacks, 5.00	3.50
Hillsville, Pa.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, 75% thru 100 mesh; sacks, 5.00; bulk	3.50
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
New Castle, Pa.—94% $CaCO_3$, 1.40% $MgCO_3$—75% thru 100 mesh, 94% thru 50 mesh; sacks, 5.00; bulk	3.50
Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk	3.00
Watertown, N. Y.—Analysis, 96 to 99% $CaCO_3$; .02% $MgCO_3$; 90% thru 100 mesh; bulk, 3.00; sacks	4.50
West Stockbridge, Rockdale, Mass., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk	3.25
Alton, Ill.—Analysis, 98% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 100 mesh	6.00
Belleville, Ont.—Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk	2.50
Chasco, Ill.—Analysis, 96.12% $CaCO_3$, 2.5% $MgCO_3$; 90% thru 100 mesh	5.00
90% thru 50 mesh	1.35
Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh	1.80@3.80
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 80-lb p. sacks 5.00; bulk	3.50
Piqua, Ohio—100% thru 10 mesh, 2.10; 50% thru 100 mesh, 2.25; 80% thru 100 mesh, 5.00; 100% thru 100 mesh; bags 7.00; bulk	5.50
Waukesha, Wis.—Analysis, neutralizing equivalent 107.38% $CaCO_3$; 99% thru 10 mesh, 55% thru 60 mesh; bulk	2.35
200-mesh bags ex., returnable	4.50
Hot Springs, N. C.—50% thru 100 mesh; sacks, 4.25; bulk	2.70
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200 lb. burlap bag, 4.00; bulk	2.75
Mountville, Va.—Analysis, 76.60% $CaCO_3$, 22.83% $MgCO_3$—50% thru 100 mesh; 100% thru 20 mesh; sacks	5.00
Colton Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk	4.00
Lemon Cove, Calif.—Analysis, 94.8% $CaCO_3$, 0.42% $MgCO_3$; 60% thru 200 mesh; sacks, 5.25; bulk	4.50
Dundas, Ont.—Analysis, 53.80% $CaCO_3$, 43.31% $MgCO_3$—35% thru 100 mesh; 50% thru 50 mesh; 100% thru 10 mesh; bagged, 4.75; bulk	3.00

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 98% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 50 mesh	1.50
Bellevue, Ohio—Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; ¼ in. to dust, about 20% thru 100 mesh	1.25
Bettendorf, Iowa, and Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Buffalo, Iowa—90% thru 4 mesh	1.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 100% thru 10 mesh, 90% thru 50 mesh	1.50
Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$; 90% thru 4 mesh	.80
Columbia, Ill., near East St. Louis—⅛-in. down	1.25@1.80
Elmhurst, Ill.—Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$; 50% thru 50 mesh	1.25
Huntington and Bluffton, Ind.—Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; about 20% thru 100 mesh	1.25

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Agricultural Limestone

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Greencastle, Indiana.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	2.00
Kansas City, Mo.—50% thru 100 mesh	1.25
Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh	1.20
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 100% thru 4 mesh; 83% thru 10 mesh; bulk	1.25
Milltown, Indiana.—Analysis, 94.41% $CaCO_3$, 2.95% $MgCO_3$; 35% thru 50 mesh	1.40@ 1.65
Mitchell, Ind.—Analysis, 97% $CaCO_3$, 1% $MgCO_3$; 50% thru 100 mesh, 90% thru 4 mesh	1.25
Montrose, Iowa.—90% thru 100 mesh	1.25
Narlo, Ohio.—Analysis, 56% $CaCO_3$ 43% $MgCO_3$; limestone screenings, 37% thru 100 mesh, 55% thru 50 mesh, 100% thru 4 mesh	1.50@ 2.00
Ohio (different points), 20% thru 100 mesh, bulk	1.25@ 1.50
Piqua, Ohio—100% thru 4 mesh	1.25
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru ⅛-in. mesh	1.30
Stone City, Iowa.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Toledo, Ohio.—¼ in. to dust, 30% thru 100 mesh	1.50
Waukesha, Wis.—No. 1 kiln dried	2.00
No. 2 Natural	1.75
Alderson, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.75
Claremont, Va.—Analysis, 92% $CaCO_3$, 2% $MgCO_3$; 90% thru 50 mesh	3.00
50% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	2.75
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$: 90% thru 50 mesh	1.50
Ladds, Ga.—Analysis, 56% $CaCO_3$, 42% $MgCO_3$—all passing 10 mesh	1.50@ 1.75
Garnett, Okla.—Analysis, 80% $CaCO_3$, 3% $MgCO_3$; 50% thru 50 mesh	.50
Kansas City, Mo., Corrigan Siding—50% thru 100 mesh; bulk	1.80
Tulsa, Okla.—90% thru 4 mesh	.50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

Glass Sand:

Berkeley Springs, W. Va.	2.25@ 2.50
Cedarville and South Vineland, N. J.—Damp, 1.75; dry	2.25
Cheshire, Mass.—24 mesh, 5.00; 40 mesh, 6.00; 100 mesh	7.00
Columbus, Ohio	1.50@ 2.00
Dunbar, Pa.—Damp	2.50
Falls Creek, Pa.	2.25
Hancock, Md.—Damp, 1.50; dry	2.00
Klondike and Pacific, Mo.	2.00@ 2.50
Mapleton, Pa.	2.25@ 2.50
Mapleton Depot, Pa.	2.50
Massillon, Ohio	3.00
Michigan City, Ind.	.50
Millville, N. J.	2.00
Mineral Ridge, Ohio	2.50@ 3.00
Montoursville, Pa.	2.00
Oregon, Ill.	2.50
Ottawa, Ill.	1.50
Pittsburgh, Pa.—Dry, 4.00; damp	3.00
Ridgway, Pa.	2.50
Rockwood, Mich.	2.50@ 2.75
Round Top, Md.	2.25
Sands, Pa.	2.50
San Francisco, Calif.	3.00@ 3.50
St. Louis, Mo.	2.50@ 3.00
St. Mary's, Pa.	2.25
Thayers, Pa.	2.25@ 2.50
Utica, Ill.	1.40@ 1.50
Zanesville, Ohio	2.00@ 2.50

Foundry Sand:

Albany, N. Y.—Core	1.25@ 2.00
Furnace lining, molding fine, molding coarse, brass molding	2.00
Sand blast	2.50@ 4.50
Allentown, Pa.—Core and molding fine	1.75@ 2.00
Arenzville, Ill.—Molding fine	1.50@ 1.75
Brass molding	1.75
Beach City, Ohio.—Core, washed and screened	2.00@ 2.50
Furnace lining	2.50@ 3.00
Molding fine and coarse	2.25@ 2.50
Cheshire, Mass.—Furnace lining, molding fine and coarse	5.00
Sand blast	5.00@ 8.00
Stone sawing	6.00
Cleveland, Ohio.—Molding coarse	1.50@ 2.00
Brass molding	1.50@ 2.00
Molding fine	1.50@ 2.25
Core	1.25@ 1.50

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Wholesale Prices of Sand and Gravel

Prices given are per ton, f. o. b., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge and So. Hts., Pa.	1.25	1.25	.85	.85	.85	.85
Attica, N. Y.	.75	.75	.75	.75	.75	.75
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		.75	.90		1.25	
Farmingdale, N. J.	.48	48	.65		1.10	
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias, N. Y.	.75	.75	.85	.85	.85	.85
Pittsburgh, Pa.	1.25	1.25	1.25	.85	.85	.85
Portland, Me.		.50	1.75		1.35	1.35
Washington, D. C. (Rewashed, river)	.75	.75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.40				.90
Barton, Wis.		.40@ .60		.50@ .70	.50@ .70	
Beloit, Wis.		.70			.80	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, Ohio	.70	.65	.90	.90	.90	.90
Columbus, Ohio	.75	.75@1.00	.75@1.00	.75	.75@1.00	.75@1.00
Des Moines, Iowa	.50	.50	1.25	1.60	1.60	1.60
			Unwashed ballast, .50 ton			
Moronts, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Oregon, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Ottawa, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Yorkville, Ill.	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80	.60@ .80
Dresden, Ohio	.70	.60	.60		.90	
Earlestead (Flint), Mich.	.70					
Eau Claire, Wis.	.40@ .50	.40	.85@1.25			.85
Elkhart Lake, Wis.	.60	.60	.70	.70	.70	.70
Grand Rapids, Mich.		.50		.80		.70
Hamilton, Ohio		1.00			1.00	
Hawarden, Iowa	.60	.50			1.60	
Hersey, Mich.	.50				.70	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Mason City, Iowa	.70	.65	1.75	1.70	1.65	1.60
Mankato, Minn.	.40‡	.40	1.25@1.35	1.25@1.35	1.25@1.35	1.25@1.35
Milwaukee, Wis.	1.11	1.11	1.36	1.36	1.36	1.36
Minneapolis, Minn.	.35	.35	1.25@1.35	1.25@1.35	1.25	1.25
Moline, Ill.	.60	.60	Concrete gravel, 40% G., 60% S., .90			
Riton, Wis.		.40			.60	
St. Louis, Mo., f.o.b. cars	1.20	1.45	1.65§	1.45		1.45‖
St. Louis, Mo., deliv. on job	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.	.65@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75
Terre Haute, Ind.	.75	.60	1.00	1.00	.75	.75
Waukesha, Wis.	.50	.50	.80	.80	.80	.80
Winona, Minn.	.40	.40	.50	.90@1.00	.90@1.00	.90@1.10
			(.05 ton discount 10 days)			
Zanesville, Ohio		.60	.60	.90	.90	
SOUTHERN:						
Atlanta, Ga.	1.24	1.24	2.79	1.90	1.90	1.90
Birmingham, Ala.	1.29	1.29	2.79	1.79	1.64	1.54
Charleston, W. Va.	all sand 1.40		all gravel 1.50			
Estill Springs, Tenn.	1.35	1.35		1.00	.85	.65
Ft. Worth, Texas	1.50@2.00	1.50@2.00	1.75@2.00	1.75@2.00	1.75@2.00	1.75@2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Lake Weir, Fla.		.50				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.00	1.00	1.80	1.80	1.80	1.80
N. Martinsville, W. Va.	1.00				1.20	.80
New Orleans, La.	.25	1.35				
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Los Angeles, Calif.		.85@1.15	1.65	1.65	1.50	1.50
Pueblo, Colo.	1.10*	.90*		1.50*		
San Diego, Calif.†	.50@ .70	.80@1.00	1.30@1.60	1.35@1.65	1.10@1.40	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.25*	1.25*	1.50*	1.25*	1.25	1.25*
Spring Valley, Calif.	.70	.80	1.40	1.35	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine sand, 1/10 in.	Sand, ¼ in.	Gravel, ½ in.	Gravel, 1 in.	Gravel, 1½ in.	Gravel, 2 in.
Atlanta, Ga.	.30@ .40	.30@ .40				
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, .80 per yd.			
Cherokee, Iowa			.80 per ton—1.20 washed			
Dresden, Ohio					.25	
Dudley, Ky. (crushed sand)	1.00	1.00		.90		
East Hartford, Conn.			.65 per cu. yd.			
Elkhart Lake, Wis.		.45				
Estill Springs, Tenn.						.85
Fishers, N. Y.		.60			.55@ .60	
Grand Rapids, Mich.						.60
Hamilton, Ohio					.70	
Hartford, Conn.		1.00*				
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Texas	.95					.55
Mankato, Minn.	All sand and gravel .60 per ton. Pit run gravel, .50					
Moline, Ill.	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Montezuma, Ind.			Road gravel .50 per ton			
Pine Bluff, Ark.			Road gravel .50			
Rochester, N. Y.	.60@ .75	.60@ .75			.50@ .65	.50@ .65
Roseland, La.	.25					
Saginaw, Mich., f.o.b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.						1.65
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waco, Texas		.80		1.50		1.30
Winona, Minn.			Washed gravel .50 to .60 a ton			
York, Pa.		.95@1.10	(crushed rock sand)			
Zanesville, Ohio		.60	.60			

*Cubic yard. †Low prices, wholesale; high prices, retail; ‡¾ inch down; §⅝ inch and less; ‖2½ inches and less.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Erie, Pa.	Crushed run slag, 4 in. and less, 1.25@1.35						
Emporium, Pa.			1.25	1.25		1.25	1.25
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, 1.50, f.o.b. Chicago						
Detroit, Mich.	All sizes, 1.65, f.o.b. Detroit						
Ironton, O.	2.05	1.45	1.80	1.45	1.45	1.45	1.45
Jackson, O.		1.35		1.35	1.35	1.35	1.35
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
Steubenville, Lowellville, Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ashland, Ky.		1.55		1.55	1.55	1.55	1.55
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton and Roanoke, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Adams, Mass.			7.00				2.90	
Bellefonte, Pa.		10.50*	10.50*	10.50*	9.00		8.50	1.80
Buffalo, N. Y.				12.00				
Berkeley, R. I.			12.00					2.30
Cassadaga, N. Y.			Agricultural marl 7.00					
Lime Ridge, Pa.							5.00a	
West Rutland, Vt.	13.50	12.00					11.00	3.20
West Stockbridge, Mass.								2.25
Williamsport, Pa.			10.00				6.00	
York, Pa. (dealers' prices)		11.50	11.50	12.50			9.50	1.85b
CENTRAL:								
Cold Springs, Ohio	12.50	11.00	10.00		9.00	11.00‖	10.00	
Delaware, Ohio	12.50	11.00	10.00	11.50	10.00		10.00	1.60
Gibsonburg, Ohio	12.50	11.00	10.00		9.00	11.00‖	10.00	
Huntington, Ind.		11.00	10.00		9.00		10.00	
Luckey, Ohio	12.50‡	11.00	10.00‡					
Marblehead, Ohio		11.00	10.00				10.00	1.60
Marion, Ohio		11.00	10.00				10.00	1.80†
Mitchell, Ind.				12.00	11.00		10.00	1.60
Sheboygan, Wis.							10.00	
Tiffin, Ohio					9.00	11.00		
White Rock, Ohio	12.50				9.00	11.00		
Woodville, O. (dlrs.' price)	12.50‡	11.00‡	10.00‡				10.00	1.60
SOUTHERN:								
Erin, Tenn.							9.00	1.50
El Paso, Texas					12.00		10.00	1.50
Karo, Va.							7.00	1.50
Knoxville, Tenn.	12.50	11.00	11.00	11.00		11.00	8.50	1.50
Ocala and Zuber, Fla.	14.00	14.00		14.00				1.75
Sherwood, Tenn.	12.50	11.00	11.00	11.00			8.50	1.50
Staunton, Va.					4.50		8.50	1.35
WESTERN:								
Colton, Calif.			15.00				19.70	
Kirtland, N. M.							12.50	15.00
San Francisco, Calif.	22.00	22.00	15.00	22.00				2.40
Tehachapi, Calif.							13.00	2.05

*Paper sacks; †180-lb. net, non-returnable metal barrel; ‡50-lb. paper bags, terms 30 days net, 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice; ‖ 80-lb. paper bags; (a) F. O. B. kilns; (b) 180 lbs. net; $2.85, 280 lbs. net.

Miscellaneous Sands

(Continued from preceding page)

Columbus, Ohio.—Core	.50@	2.00
Sand blast	4.50@	5.50
Molding fine	2.75@	3.00
Brass molding		2.50
Furnace lining	1.50@	2.00
Sand blast	3.50@	5.00
Molding coarse	1.50@	2.00
Stone sawing	1.50@	3.50
Traction	.50@	.90
Delaware, N. J.—Molding fine		2.00
Molding coarse		1.90
Brass molding		2.15
Dunbar, Pa.—Traction		2.50
Dundee, Ohio.—Glass, core, sand blast traction		2.50
Molding fine, brass molding (plus 75c for winter loading)		2.00
Molding coarse (plus 75c for winter loading)		1.75
Eau Claire, Wis.—Sand blast	3.00@	3.25
Traction	.35@	.40
Falls Creek, Pa.—Molding, fine and coarse		1.75
Sand blast		2.00
Traction		1.75
Franklin, Pa.—Core		2.00
Furnace lining		2.50
Molding fine and coarse		2.00
Brass molding		2.00
Greenville, Ill.—Molding coarse	1.30@	1.60
Joliet, Ill.—No. 2 molding sand and loam for luting purposes; milled		.80
Bank run		.65
Kansas City, Mo.—Missouri river core		.80
Kasota, Minn.—Molding fine	1.60@	1.85
Molding coarse, stone sawing	1.45@	1.75
Klondike, Pacific, Gray Summit, Mo.—Molding fine and coarse, stone sawing, roofing sand		2.00
Mapleton Depot, Pa.—Brass molding		2.00
Molding fine		2.00
Roofing sand		2.50
Mapleton, Pa. — Glass, core, furnace lining, molding fine and coarse; damp, 2.00; dry		2.75
Massillon, Ohio—Molding fine, coarse, furnace lining and core		3.00
Traction		2.75
Michigan City, Ind.—Core, traction		.50
Millville, N. J. Core		2.00
Mineral Ridge, Ohio.—Core, furnace lining, molding fine and coarse, roofing sand, sand blast, stone sawing, traction, brass molding (green)		2.25
Montoursville, Pa.—Core	1.35@	1.50
Traction		1.25
New Lexington, Ohio—Molding fine		2.25
Molding coarse		2.00
Oregon, Ill.—Core	1.50@	2.00
Sand blast		4.00
Stone sawing	2.00@	2.50
Ottawa, Ill.—Core	1.50@	2.50
Furnace lining and traction		1.50
Roofing sand		1.50
Sand blast		4.50
Stone sawing		4.50
Brass molding		2.50
Molding, coarse (crude)	.85@	1.00

Miscellaneous Sands

(Continued)

Ottawa, Minn.—Crude silica sand	.75@	1.00
Ridgway, Pa.—Core		2.00
Furnace lining, molding fine, molding coarse		1.25
Traction		2.25
Rockwood, Mich.—Core	1.90@	2.50
Roofing		2.75
Sand blast		3.75
Round Top, Md.—Molding fine		1.60
Traction		1.75
Roofing sand		2.25
San Francisco, Calif. (washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@	3.50
(Direct from pit)		
Furnace lining, molding coarse, sand blast		3.60
Stone sawing, traction		2.30
St. Louis, Mo.—Red heavy molding	1.50@	2.25
Red fine	1.50@	2.00
Molding fine and brass	2.00@	3.00
Skein core	1.75@	2.25
White core sand	1.00@	1.75
Sand blast	2.00@	4.50
Furnace lining	1.50@	2.50
Roofing sand	1.00@	1.50
Stone sawing	1.25@	2.00
Thayers, Pa.—Core		2.00
Furnace lining, molding fine and coarse		1.25
Traction		2.00
Utica, Ill.—Core, molding fine, molding coarse	.70@	1.50
Furnace lining	.85@	1.50
Roofing sand, stone sawing	1.40@	2.50
Traction, brass molding		1.40
Sand blast		2.50
Warwick, Ohio.—Furnace lining, dry 1.75, green		2.00
Molding fine and coarse, dry 2.50; green		1.75
Traction and brass molding		2.50
Core, dry	2.50@	2.75
Core, green		1.75
Zanesville, Ohio—Molding fine, brass molding	1.50@	1.75
Molding coarse		1.50

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Asheville, N. C.—Best white and 200-mesh (per ton)		8.00
Yellow (per ton)		9.00
Red (per ton)		13.00
Baltimore, Md.—Crude talc (mine run)		3.50
Ground talc (20-50 mesh), bags		10.00
Ground talc (150-200 mesh), bags		12.00
Cubes		60.00
Blanks (per lb.)		.08
Chatsworth, Ga.—Crude talc		4.50
Ground talc (150-200 mesh), bags	8.00@	12.00
Chester, Vt.—Crude talc	3.50@	5.00
Ground talc (150-200 mesh), bags	7.00@	9.00
Emeryville, N. Y.—325 mesh		14.75
Hailesboro, N. Y.—Ground talc (150-250 mesh), bags		18.00
Henry, Va. — Crude talc (lump mine run) per 2000-lb. ton	3.00@	3.50
(150-200 mesh), bags	10.00@	12.50
Keeler, Calif., bulk	17.00@	25.00
Los Angeles, Calif.—Crude	15.00@	22.00
Marshall, N. C.—Crude talc		4.50
Ground talc (150-200 mesh), bags	8.00@	12.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk, 5.00; bags		6.00
(150-200 mesh); bulk, 7.00; bags		8.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@	13.00
Rochester and East Granville, Vt.—		
Ground talc (20-50 mesh), bulk	8.50@	10.00
Ground talc (150-200 mesh), bulk	10.00@	22.00
Vermont—Ground talc (20-50 mesh); bags	7.50@	10.00
Ground talc (150-200 mesh); bags	8.50@	15.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk		5.00
(Bags 1.00 extra)		
Ground talc (150-200 mesh), bulk	8.00@	14.00
(Bags 1.00 extra)		
Pencils and steel workers' crayons, per gross	1.20@	2.00

Rock Phosphate

(Raw Rock)

Per 2240-lb. Ton

Centerville, Tenn.—B.P.L. 65%	6.00@	8.50
Gordonsburg, Tenn.—B.P.L. 68-72%	5.50@	6.00
Mt. Pleasant, Tenn.—Analysis, 65% B.P.L. (2000 lb.)		6.50
Tennessee—F. O. B. mines, gross ton, unground Tenn. brown rock, 72% min. B.P.L.		7.00
Paris, Idaho.—2000 lb. mine run, B.P.L. 75%	4.50@	5.00
Ottawa, Minn.—All crude silica sand	.75@	1.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Clay Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$10.20	$8.40	$8.10	$7.50
24x14	10.20	8.40	8.10	7.50
22x12	10.80	8.70	8.40	7.80
22x11	10.80	8.70	8.40	7.80
20x12	12.60	9.00	8.70	8.10
20x10	12.60	9.00	8.70	8.10
18x10	12.60	9.00	8.70	8.10
18x 9	12.60	9.00	8.70	8.10
16x10	12.60	8.70	8.40	7.80
16x 9	12.60	8.70	8.40	7.80
16x 8	12.60	8.70	8.40	7.80
18x12	12.60	9.00	8.70	8.10
16x12	12.60	8.70	8.40	7.80
14x10	11.10	8.40	8.10	7.50
14x 8	11.10	8.40	8.10	7.50
14x 7 to 12x6	9.30	8.10	7.50	7.50
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

(Ground Rock)

Wales, Tenn.—B.P.L. 70%	7.75
Per 2000-lb. ton	
Barton, Fla.—Analysis, 50-65% B.P.L.	3.50@ 8.00
Centerville, Tenn.—B.P.L., 65%	6.50*
Benotis, Fla.—Analysis 77-82% B.P.L.	8.00
Montpelier, Idaho. — Analysis, 72% B.P.L., crushed and dried	3.75
Mt. Pleasant, Tenn.—B.P.L. 65%	6.50
Twomey, Tenn.—B.P.L. 65%	6.50

*Less $1.00 per ton dealer commission.

Florida Soft Phosphate

(Raw Land Pebble)

Per Ton

Benotis, Fla.—Analysis 26-28% phosphoric acid—200 lb. sacks, carload lots	10.00
Florida—F. O. B. mines, gross ton, 68/66% B.P.L.	3.25
70% min. B.P.L.	3.55
72% min. B.P.L.	3.85
Jacksonville (Fla.) District	10.00@12.00

(Ground Land Pebble)

Per Ton

Jacksonville, Fla., District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65% B.P.L.	5.75

Fluorspar

Fluorspar—80% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	22.00
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	23.50

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b. quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, bulk	8.00@10.00	8.00@10.00
Creme and royal, bulk	15.00@20.00	15.00@20.00
Slate granules		6.50@ 7.00
Granville, N. Y.—Red slate granules		7.50
Harrisonburg, Va.—Blk. marble (crushed, in bags)		12.50
Ingomar, Ohio (in bags)		8.00@25.00
Milwaukee, Wis.		14.00@26.00
New York, N. Y.—Red and yellow Verona		32.00
Middlebrook, Mo.—Red		25.00@30.00
Phillipsburg, N. J.—Evergreen, bulk	8.00@10.00	8.00@10.00
Creme and royal, bulk	15.00@20.00	15.00@20.00
Poultney, Vt.—Slate granules		7.50
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.—(2000 lb.)		8.00@20.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags 12½c extra	4.50	4.50

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	27.00@35.00
Carpenterville, N. J.	19.00	31.50@45.00
Easton, Pa.	16.00	40.00@60.00
Eau Claire, Wis.	15.00@20.00	25.00@40.00
Ensley, Ala.	16.00	26.00
Eugene, Ore.	25.00@26.00	50.00@75.00
Friesland, Wis.	22.00	32.00
Houston, Tex.		19.50
Omaha, Neb.	18.00	30.00@40.00
Portland, Ore. (Del'd)	21.00	30.00@60.00
Puyallup, Wash.	20.00	60.00@75.00
Rapid City, S. D.	18.00	25.00@40.00
St. Paul, Minn.	15.00	30.00@40.00
Salem, Ore.	25.00	35.00@50.00
Salt Lake City, Utah	17.00@18.00	35.00@40.00
Springfield, Ill.	18.00	20.00@25.00
Wauwatosa, Wis.	15.00@16.00	28.00@65.00
Watertown, N. Y.	18.00@21.00	35.00@37.00
Winnipeg, Can.	18.00	26.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	11.00
Boston, Mass.	15.00@16.50
Buffalo, N. Y.	16.50
Dayton, Ohio	12.50@13.50
Grand Rapids, Mich.	11.50
Lancaster, N. Y.	15.00
Michigan City, Ind.	11.00
Milwaukee, Wis. (delivered)	14.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.	15.00
Rives Junction, Mich.	12.00
Saginaw, Mich.	12.00
San Antonio, Texas	13.00
San Antonio, Texas (deliv. city lts.)	13.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	20.00
F.o.b. cars	15.00

Gray Klinker Brick

El Paso, Texas	13.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Hydrate per Ton Common
Atlanta, Ga.	22.50	14.00
Baltimore, Md.	24.25	17.25
Cincinnati, Ohio	16.80	14.30
Chicago, Ill.	20.00	20.00
Dallas, Tex.	22.00	22.00
Denver, Colo.	24.00	......
Detroit, Mich.	21.00	20.00
Minneapolis, Minn. (white)	25.50	21.00
Montreal, Que.	......	21.00
New York, N. Y.	18.20	13.10
St. Louis, Mo.	23.20	20.00
San Francisco, Calif.	22.00	......
Seattle, Wash. (paper sacks)	24.00	......

Portland Cement

Prices per bbl. and per bag net in carload lots.

	Per Bag	Per Bbl.
Atlanta, Ga.	......	3.00
Boston, Mass.	......	2.68@2.78
Buffalo, N. Y.	......	2.53
Cedar Rapids, Iowa	.62	2.48
Cincinnati, Ohio	.63½	2.54
Cleveland, Ohio	.61½	2.46
Chicago, Ill.	.55	2.30
Columbus, Ohio	......	2.49
Dallas, Texas	.56¼	2.25†
Davenport, Iowa	.60¾	2.43
Dayton, Ohio	......	2.48
Denver, Colo.	......	2.65
Detroit, Mich.	.62	2.48
Duluth, Minn.	.56¼	2.14
Indianapolis, Ind.	.60¼	2.41
Kansas City, Mo.	.61¼	2.45
Los Angeles, Cal. (less 5c dis.)	......	2.86
Memphis, Tenn.	......	2.85
Milwaukee, Wis.	.59¼	2.46
Minneapolis, Minn.	.62½	2.61
Montreal, Canada (sks. 20c ext.)	......	2.40
New Orleans, La.	......	2.83
New York, N. Y.	......	2.40
Philadelphia, Pa.	......	2.56
Phoenix, Ariz.	......	3.30
Pittsburgh, Pa.	.56	2.24
Portland, Ore.	......	3.05
San Francisco, Cal.	......	2.63*
St. Louis, Mo.	.58¾	2.35
St. Paul, Minn.	.62½	2.61
Seattle, Wash. (10c bbl. dis.)	......	2.90
Spokane, Wash.	......	......
Toledo, Ohio	.62	2.48

†Sack 10c ext.; 10c dis. 10 days.
*Warehouse, 3.15.
NOTE—Add 40c per bbl. for bags.

Mill prices f. o. b. in Carload Lots to Contractors

	Per Bag	Per Bbl.
Buffington, Ind.	.48¾	1.95
Cincinnati, Ohio	......	3.00†
Concrete, Wash.	......	2.60
Dallas, Texas	......	2.15
Dayton, Ohio	......	2.85†
El Paso, Tex.	......	3.20*
Hannibal, Mo.	......	2.10
Hudson, N. Y.	......	2.20
Indianapolis, Ind.	......	2.96†
Leeds, Ala.	......	2.20
Los Angeles, Calif.	......	2.80
Louisville, Ky.	......	2.92†
Memphis, Tenn.	......	3.24†
Northampton, Pa.	......	2.10
Phoenix, Ariz.	......	4.30‡
Steelton, Minn.	.51½	2.06
Universal, Pa.	.50	2.00

†Including cloth sacks.
*Gross, 10c sacks and 10c per bbl. disc 10 days.
‡Gross, 15c sacks and 5c per bbl. disc. 10 days.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board ¼x32x36" Weight 1500 lb. Per M Sq. Ft.	Plaster Board ⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard. ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.	......	6.00	6.00	......	13.00	......	......	......	......	......	......	......	......
Fort Dodge, Iowa	3.00	3.50	6.00	8.00	10.00	10.50	20.00	......	21.30	20.00	20.00	......	30.00
Garbutt, N. Y.	......	......	6.00	8.00	10.00	10.00	......	7.00	......	......	......	20.00	......
Grand Rapids, Mich.	3 00	......	5.00	10.00	10.00	10.00	......	......	31.00	......	19.75	20.00	30.00
Hanover, Mont.	4 50	......	6.00	10.00	......	10.50	......	......	......	......	......	......	......
Mound House, Nev.	......	8.50	6.50	10.50@11.50	......	......	......	......	......	......	......	......	......
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	20.00	30.00
Rapid City, S. D.	4.00	......	......	10.00	11.00	11.50	......	......	33.75	......	......	......	......
San Francisco, Calif.	......	......	......	16.40	......	......	......	......	......	......	......	......	......
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	......	......	......	......	28.50	......	35.00

NOTE—Returnable Bags, 10c each; Paper Bags, $1.50 per ton extra (not returnable).
*Shipment in bulk 25c per ton less; ‡Bond plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton

News of All the Industry

Incorporations

Troy Granite Gravel Co., Purcell; capital, $50,000. Incorporators, William White, O. C. Brunn, Purcell, and E. R. Jones, Muskogee, Okla.

Beverly Stone and Sand Co., Knoxville, Tenn., increasing capital from $25,000 to $50,000.

The Kinney Sand Co. is capitalized at $40,000 and is headed by P. M. Kinney, president; C. M. Niles, vice-president; Vere Beckwith, secretary-treasurer, all of Benton Harbor, Mich.

Peter & Braghard Stone Co., Nashville, Tenn., has increased its capital from $200,000 to $300,000.

The Lancaster (Ohio) Gravel and Cement Co. has been capitalized for $40,000 by Carl B. Carling and William Stukey.

Builders Crushed Rock Products Co., Los Angeles, has been capitalized for $250,000.

Valley Cement Products Co., San Jose, Calif., is capitalized for $200,000. S. L. Whailey, San Jose, is attorney.

Mammoth Plaster and Cement Co. has been incorporated by Dr. M. J. Macfarlane, Lehi W. Jones and E. M. Corry of Salt Lake City. They will work gypsum beds near Cedar City, Utah.

Chico Crushed Stone Co. is incorporated at Wichita Falls, Texas, for $100,000 by G. D. Anderson, J. A. Kemp and A. W. King.

MacArthur Concrete Pile and Foundation Co., Delaware corporation, Wisconsin agent Vroman Mason, Madison, total authorized capital stock $375,000. Proportion to be used in Wisconsin $25,000.

The Muskingum Clay, Sand and Gravel Co., Zanesville, Ohio; capital, $10,000; Carl O. Bolin, Ralph D. Karns, Laura A. Karns and Blanche M. Bolin.

Kenmore & Onondaga Sand Co. of Buffalo, N. Y., Inc.; capitalized at $33,500; directors, Frank O. Fulmer, Willis E. Waterman, Edward A. Hunt and Fred A. Tyler.

Mendolia Brothers, Richmond Hill, cement blocks, $10,000; Domenico Mendolia, Richmond Hill; Demenico Cristando, Joe Mendolia, 133 Wilson avenue, New York.

Liberty Concrete Corp., Brooklyn, $15,000; J. F. Martucci, J. F. Hector, J. Mattanna. (Attorney, D. B. Getz, 215 Montague street, Brooklyn, N. Y.)

Plum Point Molding Sand Co., Wilmington. Carry on and conduct a general molding and coarse sand business with the right to mine and excavate; capital, $500,000.

Vernon Asphalt Co., Nevada, Mo., chartered with capital of $50,000.

The Wiegand Concrete Products Co. has been incorporated with a capital stock of $25,000 at Prebel, Wis., postoffice at Green Bay, by Ernest Wiegand, Frank Wiegand and others.

Iowa Concrete Brick Co. has been incorporated with a capital stock of $100,000 and will establish a plant near Muscatine, Iowa. Incorporators are Frank M. Lytle and J. E. Kranz.

Santa Monica Rock and Gravel Co. has been incorporated in Los Angeles, Calif., with a capital of $60,000 by Wm. H. Moore, Wm. Moore and Walter E. Hoover of Los Angeles.

Fairfax Ping Granite Co. has been incorporated in Cherrydale, Va., with a capital stock of $50,000. John T. Malone is president and John C. Daley is secretary.

Spiro Gravel Co. has been incorporated in Spiro, Okla., with a capital stock of $50,000 by E. B. Davis, W. W. Brown, Jr., and M. I. Border, all of Oklahoma City, Okla.

French Sand Dryer Co. has been organized in Keystone, W. Va., by C. S. French, S. A. Christie, J. E. Cruis and others and will build a foundry to manufacture dryers.

Sand and Gravel

Waupaca (Wis.) Sand and Gravel Co., operating a pit near highway 18 at Lake Emily, has been sued by the county supervisors on the grounds that its operations endanger the highway.

Fountain Sand and Gravel Co., Pueblo, Colo., has increased its first year's output 600 per cent. Fred H. Bullen is president and Joe Bullen, secretary of the company.

Copley gravel pit near Akron, Ohio, formerly known as the Hurdon Co., has been opened after a three years' shutdown.

Stillwell Sand and Gravel Co., Anderson, Ind., has recently opened a gravel pit in the east end of Anderson. T. L. Stillwell is head of the company.

At Laverne, Okla., a deposit of cement gravel has been opened and is being used for street paving.

Bids for filter sand have been received for the Albany, N. Y., filtration plant. Ulster Davis bid $2300, specifying Hudson river sand, and Peter McCabe offered to furnish Cape May sand for $11,703.50.

Baker Towboat Co., Tuscaloosa, Ala., has leased ground on the Warrior river near the railroad bridge for storing and shipping though the Riverview terminals in Tuscaloosa.

Clinton (Ill.) Sand and Gravel Co. has begun loading at its switch on the I. C. railroad.

Greenlawn Gravel Co., Columbus, Ohio, will have its new plant in operation some time in October. This is a subsidiary of the Columbus Consumers Supply Co. Herbert R. Gill is president of both companies.

Island Sand and Gravel Co., Columbus, Ohio, some time ago issued $100,000 8 per cent bonds, redeemable in 10 years at 102. President Gill said that business has been so good that $50,000 of that issue has been redeemed in 30 months.

Kaiser Sand and Gravel Co. is just completing its new washing plant on the outskirts of Livermore, Calif. A crew of 40 men are working day and night on construction.

Seattle Sand and Gravel Co. is building a $70,000 plant at Ranier beach, Seattle, Wash. Gravel will be dredged at Renton and brought in on barges for washing and screening.

Automatic Gravel Co., Muscatine, Iowa, has won its suit against three insurance companies for its loss by fire last fall. The Niagara Fire Insurance Co. will pay $1324.25, the Northern Assurance Co. pays $1324.25 and the Marquette National Fire Insurance Co. will pay $1666.60. The case against the American Central Insurance Co. was dismissed.

Knoxville (Tenn.) Sand and Lime Co. has secured an option for a seven-acre tract on the river front in Knoxville on which a modern sand and gravel plant will be erected.

Orange County Rock and Gravel Co. of Long Beach, Calif., has been awarded a contract for 15,000 tons of sand at $5250 and 20,000 tons of gravel at $15,000, according to the Long Beach Sun.

Sound Sand and Gravel Co., a new concern of Seattle, Wash., is building bunkers on Lake Union. A. S. Kerry is president.

Quarries

Italian Marble Products Co. made the first shipment of marble chips from the new plant at Spokane during the week. This shipment was of two large cars and went to a concern in Seattle.

The Washington State Highway Department is installing a crusher near Davenport, Wash.

Walter Doolin and M. L. Harris have contracted to furnish crushed rock for the roads of Creek county, Oklahoma. They have set up a crusher near Oilton on the Doolin ranch.

The Thompson Paint Co. of Kansas City, Kan., which is putting in a large pulverizing plant at Stamat, in Marion county, Arkansas, will get its pigment stone from a quarry near Cartney, 18 miles south in Baxter county. This stone for years has been known as lithographing stone, but because of small silica spots it could not be used for that purpose. Mr. Thompson, head of the company, is a chemist and through experiments found that the stone had other commercial qualities.

R. G. Lassiter of Greensboro, N. C., has leased the county quarry of Bruce county for three years on a percentage basis. The quarry and equipment cost $84,000 in 1920.

H. D. Meyer of Carver has offered to sell his quarry, 7½ acres of land in Scott county near the Minnesota river, for $30,000 to the city of Minneapolis. Mr. Meyer said that crushed limestone from his quarry, suitable for pavement base construction, can be placed on track in Minneapolis for 3 cents a hundred-weight. Mr. Dutton estimated that this rock, unloaded here, would cost not less than $1 a cubic yard and considerably more laid down at the job. Committee members declared these figures too high to hold forth any prospect of savings to the city but voted to include Mr. Meyer's quarry among those to be investigated in detail.

The city of Minneapolis has voted $125,000 to buy a rock quarry or a municipal gravel pit to obtain highway materials.

Orofino Lime and Fertilizer Co. of Orofino, Idaho, has begun actual quarrying and shipping of limestone.

The state has no power to regulate operations of a stone crusher on private property, although the city council may regulate the strength of blasts in the city limits. This is the gist of an opinion rendered by the city solicitor of Dubuque, Iowa.

Strickler's stone quarries at Clifton Springs, Pa., abandoned a number of years ago, will again be put into operation in a few days. Years ago this same quarry supplied the limestone and burned lime for this entire vicinity.

Los Angeles (Calif.) Rock and Gravel Co., through its president, H. M. Hawley, has made a proposal, which if accepted by the city, would reopen the operation of rock crushers in the Arroyo Seco, for the next three years, and cut into territory which remains in its virgin state. In his proposal, Hawley offers the city, in return for the privilege of operating his rock crushers from Avenue 20 to a point several hundred yards north of Sycamore Grove, rights of way for the proposed double 50-ft. boulevard from Los Angeles to Pasadena, as well as pledging to erect concrete walls in a 100-ft. channel for flood control. In addition, Hawley declares that he will sell to the city at half the market price rock, sand and gravel which will be needed in the building of the proposed boulevard system. Hawley contends that the offers which he makes the city will effect a saving of at least $300,000. The council referred the matter to the attention of its welfare committee for consideration.

Granite Rock Co. of Santa Cruz, Calif., is erecting bunkers to handle different grades of crushed rock.

The National Crushed Stone Co. of Sioux Falls, S. D., is having plans drawn for a stone crushing plant to cost about $30,000.

H. V. Gentry, 149 South Manhattan place, Los Angeles, Calif., is about to add to his rock crushing plant on Telfair street.

The government rock quarry at Little Cedar Cliff, near Madison, Ind., is discontinued and the work of dismantling the equipment has begun. This will require about a month, during which period the rock quarried also will be removed. The discontinuance of the quarry is due to no more stone of this kind being needed for the dams above. The quarry was opened about four years ago and during the entire period was operated with the exception of the winter months. At its maximum the quarry employed around 100 men and payrolls ranged from $5000 to $7000 monthly.

The Henrici Lowry-Engineering Co., Kansas City, Mo., is preparing plans for the installation of a quarry and crushing plant at Murfreesboro, Ark., for a company whose name will be announced later. The installation will include a steam-operated power plant, pumping machinery, hydraulic mining equipment, loading and crushing machinery and auxiliary equipment.

Cement

The Clinchfield Portland Cement Co., Kingsport, Tenn., has acquired the cement and lime plant and machinery of W. E. Culbert, near Perry, Ga., and will use the equipment in connection with its new plant on property recently acquired in this section. Considerable additional equipment will be installed at the projected plant, designed to develop an output of 4000 bbl. per day. It is estimated to cost $2,500,000.

J. H. Kempster has been appointed general su-

(Continued on page 68)

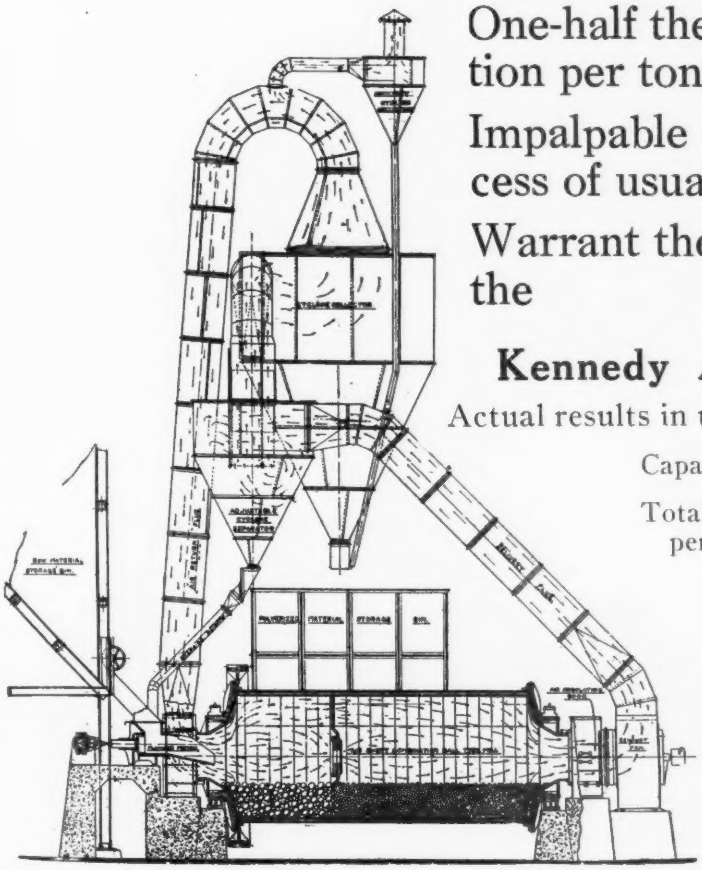
A Revolutionary Development in Pulverizing

Twice the usual capacity for mills of same size;

One-half the usual power consumption per ton of finished material;

Impalpable powder greatly in excess of usual percentage;

Warrant the above statement about the



Kennedy Air-Swept Tube Mill

Actual results in use on grinding limestone* show:

Capacity of 11.8 tons per hour.

Total power consumed less than 11 H.P. per ton.

Product in First Cyclone	84.5%	minus 200 mesh
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	99.2%	minus 100 mesh

All product from Second Cyclone passing 350 mesh seive.

Dryers ordinarily unnecessary. High percentage of moisture dissipated by air passing through mill.

Grinding is accomplished by a slowly revolving mass of balls against steel renewable liners.

This insures maximum continuous operation. Finished product is air swept from mill immediately upon reaching required fineness. Fineness of product is controlled by regulating velocity of air through mill.

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*Name and location of plant on request.

Cement

(Continued from page 66)

perintendent of the Buffington plant of Universal Portland Cement Co. located at Buffington, Ind., succeeding the late C. O. Soderquist. This plant consists of mills Nos. 3, 4 and 6. In 1907, two years after graduation as chemical engineer from the University of Michigan, Mr. Kempster entered the service of the company as chemist of the plant at South Chicago. In 1908 he was appointed chemist of the Buffington plant and in 1915 was advanced to the superintendency of mills No. 3 and 4. Three years later he became superintendent of mill No. 6, which position he has held as general superintendent of the Buffington plant.

Lehigh Portland Cement Co. employes are reported to have struck for a 25 per cent pay increase and an eight-hour day.

Missouri Portland Cement Co. will erect a warehouse 70x42 ft. at 4142 Mermac street, St. Louis.

Yosemite Portland Cement Co., Merced, Calif., has reached an agreement with the board of supervisors regarding the right to build a spur track from Merced to Oakdale.

Lime

Eagle Rock Lime Co. (Virginia) has just installed a Schaffer hydrator.

E. Dillon & Sons, Indian Rock, Va., has just installed a hydrating plant.

Formal hearing before the Southern Freight Association in Atlanta in connection with the new schedule of rates on lime between points in the Southern territory submitted to the Birmingham Traffic Association by the railroads has been announced by traffic association officials who will represent Alabama lime dealers at the hearing. It is stated the new schedule of lime rates will bring about a better alignment from Alabama producing points versus Tennessee producing points to the lower Mississippi valley territory, in that at the present time Sherwood, Tenn., one of the largest points of production in east Tennessee, can ship to certain points in the Mississippi valley at the same rates, and in some cases lower rates than effective from Alabama points, although the distance is greater in favor of the latter. The lime producing points in Alabama are Longview, Cumberland, Greystone, Wilmay, Newala, Fort Payne, Saginaw, Keystone, Varnons and Roberta.

Floyd and Stanley Overall of Murfresboro, Tenn., have recently purchased the second largest lime plant in the state. It is situated near Summitville, in Coffee county, and consists of 1100 acres of well timbered lands, together with the plant formerly operated by the Tennessee Lime and Cement Co.

Phosphate Rock

Pleasing increase in phosphate export tonnage last month appears in the records kept by C. S. Hoskins, traffic manager of the Tampa Board of Trade. The volume of August exports has been exceeded only three times in the last three years. The foreign shipments last month amounted to 61,351 long tons, being exceeded by May, 1922, when 72,386 tons were shipped and two other times.

The British superphosphate industry is now faced with virtual extinction. For nearly two years past the superphosphate manufacturers of the United Kingdom have had to contend with unequal competition from foreign countries with depreciated currencies. In order to retain his connection, protect his capital invested in buildings and in plant, and employ his workmen and staff, the British superphosphate manufacturer has, during recent years, suffered severe losses, and it is now abundantly clear that the industry cannot remain much longer in existence. The uncontrolled importation into the United Kingdom of the surplus production of fertilizers, from countries abroad with abnormally depreciated currencies, will ultimately prove to be not only a danger to agriculture but a menace to the safety of the whole nation, according to a letter to the London Times.

Eldor Nance, Dallas, Texas, has leased 104 acres of land containing phosphate rock, which he plans to develop.

There is considerable evidence of a renewed activity in the hard rock phosphate section of Florida, from which a number of cargoes are being shipped at present. Some of the mines are getting in shape to renew operations after their long period of inactivity.

Pacific Coast Fertilizer Co. of Paris, Idaho, has taken a five-year lease on the mine of the Western Phosphate Co. in Paris canyon and plan to begin taking phosphate ore out at an early date. It is said that the company is under contract to furnish two carloads of phosphate ore daily for the period of the lease. The people of Paris are jubilant over the prospects of an early resumption of phosphate mining. It is estimated that approximately 50 men will be employed at the mine.

Silica Sand

Greenville Silica Products Co. of Greenville, Pa., is a new corporation which has purchased the quarries and equipment of the Greenville Silica Co.

The Bureau of Mines will shortly undertake a study of the mining, preparation and uses of silica. The investigation will cover the range of quartzite, sandstone, sands of all kinds, tripoli, diatomaceous earth, flint and rottenstone. The investigation will consist of library research, correspondence and field study, leading to possible findings and recommendations for improvement in efficiency, safety and quality of products.

Paul R. Riley, secretary of the Chamber of Commerce, and H. H. Howard, owner of several large glass plants in the United States, were in Chickasha recently looking over the advantages of Chickasha, Okla., as a location for a glass factory. Howard at present has plants in Shreveport, La., and Urbana, Ohio. He is expecting to move his plant from Shreveport because of climatic conditions.

Ella M. and John G. Ryburn of Mt. Vernon, Ohio, have filed a petition in Common Pleas court here asking for the appiontment of a receiver for the Washington Silica Sand Co. of Knox county. The Ryburns hold judgments against the company in the sum of $17,985.16.

Peter Rebhahn, formerly the manager of the Seattle Brick and Tile Co., Seattle, Wash., has gone into the sand business and with every ship that comes from Holland he gets some of the fine white sand for glass making and core building.

Agstone

Grinding limestone for Grant county farms has become a big industry. Nearly all townships are buying machines for this work costing, delivered, $750 each. Two local men formed a partnership for commercializing the industry. They ordered a plant which will cost $5000. The new type of machine will crush stone for road building as well, says the Milwaukee, Wis., Sentinel.

The Mississippi Lime and Material Co. of Alton, Ill., and the Columbia Quarry Co. at St. Louis, Mo., will each give away (free) a carload of limestone, freight prepaid, at the Macoupin county fair this year. Harry H. Masterson of Virden was the lucky man to win the carload given by the Mississippi Lime and Material Co. at the fair last fall.

Concrete Products

The Concrete Products Association of Southern California has changed its name to the Associated Concrete Industries. The association was organized a year and a half ago, the meetings taking the form of dinners and being held in different cities. The last meeting was held in Whittier, Calif., September 25. The officers of the company at the present time are: R. E. Johnston, Concrete Brick and Tile Co., president; M. G. Watkins, Los Angeles Concrete Tile Co., vice-president; Harley Wadsworth, secretary.

The Crystal Rock Stucco Co. of Bremen, Ohio, is about to begin the construction of a $75,000 plant. Contracts awarded.

Bangor Cast Stone Products Co., Bangor, Maine, has been taken over by George Cuozzo of Bangor.

The Cinder Block Corp., 1102 Lexington building, Baltimore, Md., is about to erect an addition to its plant on Kate avenue.

The Indiana Reinforced Concrete and Culvert Co., manufacturers of concrete pipe, cement blocks and other cement products, has begun the erection of a new plant at Indianapolis. The building will be a one-story frame structure 90 ft. wide and 120 ft. long. The company plans to abandon the plant at 702 Morris street on its removal to the new factory building. The business is owned and managed by E. S. Smith.

Trade Literature

The Material Handling Advisory Bureau issues a folder describing its service of advisory and technical consultation.

The Harrington Co. put out an interesting little folder on the Harrington chain hoists and travelers.

The Sharples Specialty Co. have issued a bulletin on "Emulsions and Their Resolution," describing the work of the Sharples super centifuge.

The Osgood Co. has issued Bulletin No. 236, covering the new Osgood 1¼ yd. heavy duty steam shovel.

The Chemical Catalog Co. has issued the eighth edition of the Chemical Engineering Catalog, a very handsome leather bound volume containing a great deal of important general information as well as specific information regarding the items catalogued. It includes tanks, tube mills, pipe, motors and other things used in the rock products field.

The Burke Electric Co. has put out Bulletin No. 128 which covers the polyphase induction motors made by this company.

The Brown Instrument Co., Philadelphia, issues a very interesting booklet on their recording instruments.

Industrial Works, Bay City, Mich., has put out a handsome bulletin on clam shell buckets.

Trade Notes

The Midwest Air Filters, Pacific, San Francisco, has been incorporated to distribute the products of the Midwest Steel and Supply Co. of New York.

The Harrington Co. is the new name which has been adopted by Edwin Harrington, Son & Co. of Philadelphia.

The Flint Rock Stucco Co., Inc., announces the removal of its general offices to the Dayton Builders Exchange Bldg., Dayton, Ohio. M. A. Spayd will have charge of the office.

The Premier Reconstructed Stone Products Co. of Millville, N. J., announces that hereafter the main office will be at the plant on the Central railroad at Dividing Creek, N. J.

The New Jersey Concrete Products Corp. announces that it has moved its office to Dover, N. J. F. E. Cadwell is president.

Indiana Portland Cement Co.'s Greencastle office has been moved to the State Life building, Indianapolis.

R. P. Kite of the Dorr Co. has been transferred from the New York to the Chicago offices of the company.

J. E. Cousins, Jr., Prince George, Va., has inquiries out for a gas engine, well-drilling tools and machinery.

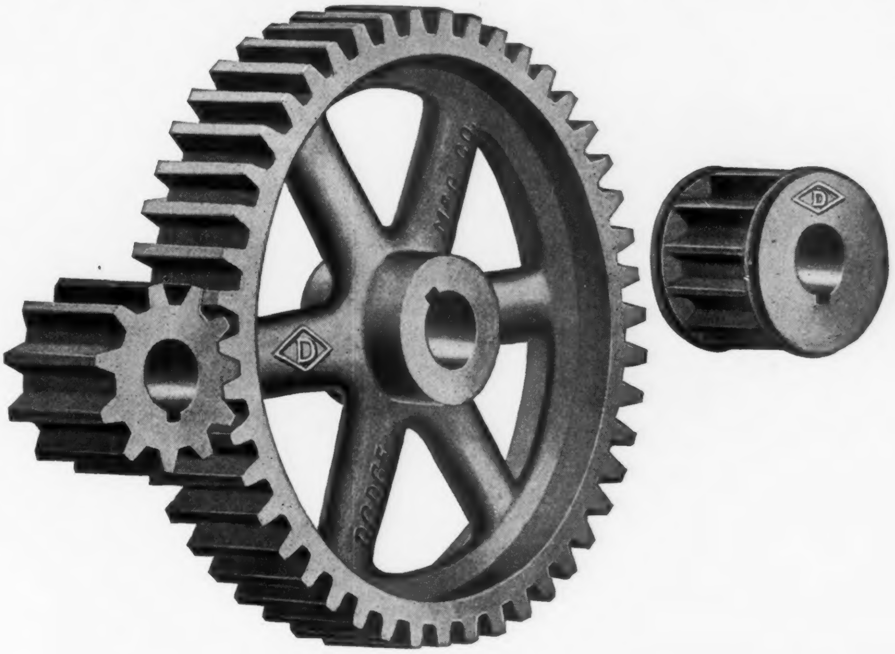
Talc

The Vermont Talc Co., Chester, Vt., reports a revival of demand for talc after two months of little or no buying.

Obituary

F. W. Cook, vice-president of the San Antonio Portland Cement Co., San Antonio, Texas, died on Monday, September 3.

Dependable Gearing



Your gearing requirements can be quickly supplied from the Dodge line

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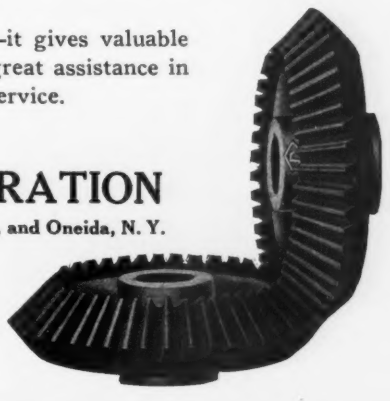
Our stock of gear patterns is most complete—our facilities for gear design and construction are the result of over thirty years' experience. Dodge service assures prompt attention to your orders.

Write for our gear book—it gives valuable information that will be of great assistance in selecting gears for general service.



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Classified Directory of Advertisers in this issue of Rock Products

Air Compressors
Pennsylvania Pump & Compressor Co., Easton, Pa.

Air Separators
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Universal Road Mchy. Co., Kingston, N. Y.

Automatic Weighers
Merrick Scale Mfg. Co., Passaic, N. J.
Richardson Scale Co., Passaic, N. J.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

Babbitt Metal
Ajax Metal Co., Philadelphia, Pa.
Lewistown Fdy. & Machine Co., Lewistown, Pa.

Bags and Bagging Machinery
Jaite Co., Jaite, Ohio

Balls (Tube Mill, etc.)
Hadfield-Penfield Steel Co., Bucyrus, Ohio

Belt Fasteners and Hooks
Crescent Belt Fastener Co., New York City

Belt Lacing and Rivets
Crescent Belt Fastener Co., New York City

Bins and Bin Gates
Austin-Western Road Machinery Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, Ohio
Easton Car and Construction Co., Easton, Pa.
Smith Engineering Works, Milwaukee, Wis.
W. Toepfer & Sons Co., Milwaukee, Wis.
Weller Mfg. Co., Chicago, Ill.

Blasting Powder
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio

Boiler Insulation
Celite Products Co., Chicago, Ill.

Boilers (Water Tube)
Jackson & Church Co., Saginaw, Mich.

Box Car Loaders
Ottumwa Box Car Loader Co., Ottumwa, Iowa

Brick Machinery
Hadfield-Penfield Steel Co., Bucyrus, Ohio
Jackson & Church Co., Saginaw, Mich.
Shope Brick Co., Portland, Ore.

Buckets (Elevator and Conveyor)
American Manganese Steel Co., Chicago Heights, Ill.
Austin Mfg. Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, Ohio
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, Ohio
Lewistown Fdy. & Machine Co., Lewistown, Pa.
Smith Engineering Works, Milwaukee, Wis.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.
W. Toepfer & Sons Co., Milwaukee, Wis.
Weller Mfg. Co., Chicago, Ill.

Buckets (Grab, Clambshell, etc.)
Brown Hoisting Mchy. Co., Cleveland, Ohio
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, Ohio
Orton & Steinbrenner Co., Chicago, Ill.

Burr Mills
Butterworth & Lowe, Grand Rapids, Mich.
Munson Mill Machinery Co., Utica, N. Y.

Cableways
Clyde Iron Works Sales Co., Duluth, Minn.
Interstate Equipment Corp., New York, N. Y.

Calcining Kettles (Gypsum)
American Process Co., New York, N. Y.
Butterworth & Lowe, Grand Rapids, Mich.

Car Movers
Atlas Railway Supply Co., Chicago, Ill.

Car Pullers
Ottumwa Box Car Loader Co., Ottumwa, Iowa
Thomas Elevator Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

Cars (Quarry)
Atlas Car & Mfg. Co., Cleveland, Ohio
Easton Car and Construction Co., Easton, Pa.
United Iron Works, Inc., Kansas City, Mo.

Chain (Steam Shovel)
Carroll Chain Co., Columbus, Ohio

Chain Drives
Dodge Mfg. Corp., Mishawaka, Ind.
Link-Belt Co., Chicago, Ill.

Clamps
Knox Mfg. Co., Philadelphia, Pa.

Clutches
Dodge Mfg. Corp., Mishawaka, Ind.
The Hill Clutch Co., Cleveland, Ohio

Coal Pulverizing Equipment
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fuller-Lehigh Co., Fullerton, Pa.
K-B Pulverizer Co., Inc., New York City
Pennsylvania Crusher Co., Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.

Colors (Cement and Mortar)
C. K. Williams & Co., Easton, Pa.

Conveyors and Elevators
Austin-Western Road Machinery Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, Ohio
Dodge Mfg. Corp., Mishawaka, Ind.
Jeffrey Mfg. Co., Columbus, Ohio
Kennedy-Van Saun Mfg. & Eng. Corp., New York City
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Smith Engineering Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
W. Toepfer & Sons Co., Milwaukee, Wis.
United Iron Works, Inc., Kansas City, Mo.
Universal Crusher Co., Cedar Rapids, Iowa
Universal Road Mchy. Co., Kingston, N. Y.
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.

Core Drilling
Pennsylvania Drilling Co., Pittsburgh, Pa.

Couplings
Knox Mfg. Co., Philadelphia, Pa.

Cranes (Crawler)
Brown Hoisting Mchy. Co., Cleveland, Ohio
Bucyrus Co., S. Milwaukee, Wis.
Byers Machine Co., Ravenna, Ohio
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Koehring Co., Milwaukee, Wis.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., Marion, Ohio

Cranes (Locomotive)
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, Ohio
Bucyrus Co., S. Milwaukee, Wis.
Byers Machine Co., Ravenna, Ohio
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Northwest Engineering Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, Ohio
Orton & Steinbrenner, Chicago, Ill.
Osgood Co., Marion, Ohio

Cranes (Overhead Electric Traveling)
Morgan Engineering Co., Alliance, Ohio

Crushers (Hammer)
Jeffrey Mfg. Co., Columbus, Ohio
Pennsylvania Crusher Co., Philadelphia, Pa.
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.

Crushers (Jaw and Gyratory)
Acme Road Mchy. Co., Frankfort, N. Y. (Jaw)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin-Western Rd. Mchy. Co., Chicago, Ill.
C. G. Buchanan Co., New York City
Butterworth & Lowe, Grand Rapids, Mich.
Kennedy-Van Saun Mfg. & Eng. Corp., New York City
Lewistown Fdy. & Machine Co., Lewistown, Pa. (Jaw)
Morgan Engineering Co., Alliance, Ohio
New Holland Machine Co., New Holland, Pa.
Smith Engineering Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
United Iron Works, Inc., Kansas City, Mo. (Jaw)
Universal Crusher Co., Cedar Rapids, Iowa
Universal Road Mchy. Co., Kingston, N. Y.
Webb City & Carterville Fdy. & Mch. Works, Webb City, Mo. (Jaw)

Crusher Protectors
Dings Magnetic Separator Co., Milwaukee, Wis.

Crushing Rolls
C. G. Buchanan Co., New York City
Kennedy-Van Saun Mfg. & Eng. Corp., New York City
McLanahan Stone Machine Co., Hollidaysburg, Pa.
New Holland Machine Co., New Holland, Pa.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
United Iron Works, Inc., Kansas City, Mo.
Webb City & Carterville Fdy. & Mch. Works, Webb City, Mo.

Derricks
Clyde Iron Works Sales Co., Duluth, Minn.
Thomas Elevator Co., Chicago, Ill.

Dippers and Teeth (Steam Shovel)
American Manganese Steel Co., Chicago Heights, Ill.
Erie Steam Shovel Co., Erie, Pa.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

Draglines
Bucyrus Co., S. Milwaukee, Wis.
Erie Steam Shovel Co., Erie, Pa.
Koehring Co., Milwaukee, Wis.
Northwest Engineering Co., Chicago, Ill.
Osgood Co., Marion, Ohio

Dragline Cableway Excavators
Erie Steam Shovel Co., Erie, Pa.
Link-Belt Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.
Thomas Elevator Co., Chicago, Ill.

Dredge Chain
Carroll Chain Co., Columbus, Ohio

Dredges (Hydraulic)
Bucyrus Co., South Milwaukee, Wis.

Dredges (Sand and Gravel)
American Manganese Steel Co., Chicago Heights, Ill.
Morris Machine Works, Baldwinsville, N. Y.
Thomas Elevator Co., Chicago, Ill.

Drills (Blast Hole)
Armstrong Mfg. Co., Waterloo, Iowa
Sanderson-Cyclone Drill Co., Orrville, Ohio

Dryers
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Process Co., New York, N. Y.
Buckeye Dryer Co., Chicago, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio
Kennedy-Van Saun Mfg. and Eng. Corp., New York, N. Y.
Lewistown Fdy. & Machine Co., Lewistown, Pa.
McGann Mfg. Co., York, Pa.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

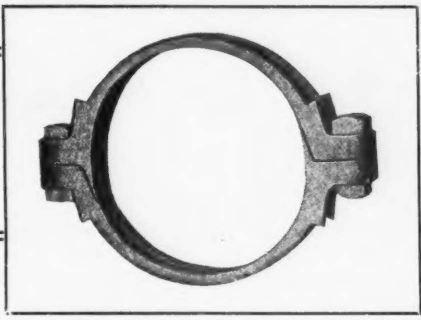
Dust Collecting Systems
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.

Dynamite
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Engineers
Acme Road Mchy. Co., Frankfort, N. Y.
J. C. Buckbee Co., Chicago, Ill.
Robt. W. Hunt & Co., Chicago, Ill.
Kritzer Co., Chicago, Ill.
Richard K. Meade & Co., Baltimore, Md.
McGann Mfg. Co., York, Pa.
H. Miscampbell, Duluth, Minn.
Pennsylvania Drilling Co., Pittsburgh, Pa.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.
R. D. Wood & Co., Philadelphia, Pa.

Engines (Gasoline, Kerosene and Oil)
American Hoist & Derrick Co., St. Paul, Minn.
Armstrong Mfg. Co., Waterloo, Iowa
Climax Engineering Co., Clinton, Iowa
Power Mfg. Co., Marion, Ohio

"REX"



MALLEABLE HOSE CLAMP

If you will look about you, you will see "KNOX" specialties are swiftly finding favor among producers of non-metallic minerals.

Behind this instant popularity is the keen appreciation of a product that always gives satisfactory service under severest conditions.

"REX" Malleable Hose Clamps made either in single or double bolt style are exceptionally strong and pliable. They will not stretch under tension, neither will the tongue curl up. They are not only superior to brass clamps but less expensive.

THE KNOX MFG. CO., 821 Cherry St., PHILADELPHIA

Try them. If they are not the best you have ever used, return them at our expense.

KNOX

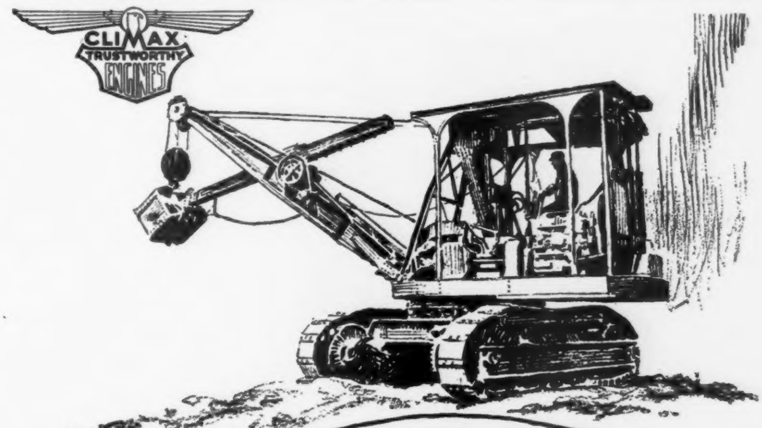
Valves-Couplings-Nipples-Clamps-Menders

"Go-Getters"

One of the most commonly noted features about any machine equipped with a Climax Engine is the ease and speed with which it does its share of the work.

There never seems to be any lack of power and capacity.

The men that work with it and around it catch this spirit of "Getting Things Done" quickly and right.



Be sure your new eouipment is powered with

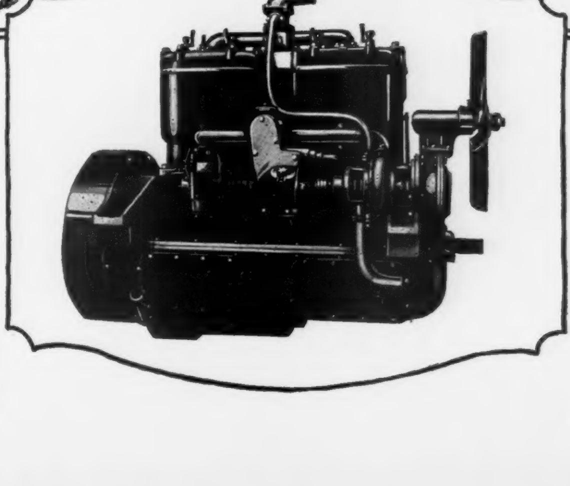
CLIMAX

"The Trustworthy Engine"

Write for Catalog

Climax Engineering Co.
22 W. 18th Ave., Clinton, Iowa

USED BY
Bay City Dredge Works, Bay City, Mich.; Byers Machine Co., Ravenna, Ohio; Victor R. Browning, Cleveland, Ohio; Link Belt Co., Chicago, Ill.; Locomotive Crane Co. of America, Champaign, Ill.; Moore Speedcrane, Inc., Chicago, Ill.; Northwest Engineering Co., Green Bay, Wis.; Orton & Steinbrenner, Huntington, Ind.; and others.



Buyers' Directory

of the Rock Products Industry

Classified Directory of Advertisers in this issue of Rock Products

Engines (Steam)
American Hoist & Derrick Co., St. Paul, Minn.
Clyde Iron Works Sales Co., Duluth, Minn.
Jackson & Church Co., Saginaw, Mich.
Morris Machine Works, Baldwinsville, N. Y.

Explosives (See Blasting Powder and Dynamite)

Frogs and Switches
Central Frog & Switch Co., Cincinnati, Ohio
Easton Car and Construction Co., Easton, Pa.

Fuses (Detonating and Safety)
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio

Gas Producers
Morgan Construction Co., Worcester, Mass.
R. D. Wood & Co., Philadelphia, Pa.

Gears (Spur, Helical, Worm)
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

Grizzlies
Austin Mfg. Co., Chicago, Ill.
Robins Conveying Belt Co., New York City
W. Toepfer & Sons Co., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.

Gypsum Plaster Plants
Butterworth & Lowe, Grand Rapids, Mich.

Hoists
American Hoist and Derrick Co., St. Paul, Minn.
Clyde Iron Works Sales Co., Duluth, Minn.
Hyman-Michaels Co., Chicago, Ill.
Industrial Works, Bay City, Mich.
Jackson & Church Co., Saginaw, Mich.
Thomas Elevator Co., Chicago, Ill.
United Iron Works, Inc., Kansas City, Mo.
Vulcan Iron Works, Wilkes-Barre, Pa.
Weller Mfg. Co., Chicago, Ill.

Hose Menders
Knox Mfg. Co., Philadelphia, Pa.

Hydrators (Lime)
Kritzer Co., Chicago, Ill.
Richard K. Meade & Co., Baltimore, Md.
H. Miscampbell, Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa
Steacy-Schmidt Mfg. Co., Philadelphia, Pa.

Insulation (Heat)
Celite Products Co., Chicago, Ill.

Kilns (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Kennedy-Van Saun Mfg. & Eng. Corp., New York City
McGann Mfg. Co., York, Pa.
H. Miscampbell, Duluth, Minn.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

Kilns (Shaft)
McGann Mfg. Co., Inc., York, Pa.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

Lime Handling Equipment
Kritzer Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
H. Miscampbell, Duluth, Minn.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Steacy-Schmidt Mfg. Co., Philadelphia, Pa.
Sturtevant Mill Co., Boston, Mass.

Liquid Fuel Equipment
W. N. Best Corp., New York City

Loaders and Unloaders
Brown Hoisting Mchy. Co., Cleveland, Ohio
Jeffrey Mfg. Co., Columbus, Ohio
Link-Belt Co., Chicago, Ill.
Northwest Engineering Co., Chicago, Ill.
Ottumwa Box Car Loader Co., Ottumwa, Iowa

Locomotives (Steam, Gas, and Electric)
Baldwin Loco. Wks., Philadelphia, Pa. (Steam)
Davenport Loco. Wks., Davenport, Iowa (Steam and Gas)
Fate-Root-Heath Co., Plymouth, Ohio (Gas)
Ironton Eng. Co., Ironton, Ohio (Electric)
Jeffrey Mfg. Co., Columbus, Ohio (Electric)
Lima Locomotive Works, Lima, Ohio (Steam)
Milwaukee Loco. Mfg. Co., Milwaukee, Wis. (Gas)
Vulcan Iron Works, Wilkes-Barre, Pa. (Steam)

Lubricating Systems
Ottumwa Box Car Loader Co., Ottumwa, Iowa

Magnetic Devices (Pulleys, etc.)
Dings Magnetic Separator Co., Milwaukee, Wis.

Manganese Steel (Castings, Repair Parts, etc.)
American Manganese Steel Co., Chicago Heights, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

Mills, Grinding (Ball, Tube, etc.)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jackson & Church Co., Saginaw, Mich.
Lewistown Fdy. & Machine Co., Lewistown, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Steacy-Schmidt Mfg. Co., Philadelphia, Pa.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.

Motors and Generators (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Nipples
Knox Mfg. Co., Philadelphia, Pa.

Nozzles
Knox Mfg. Co., Philadelphia, Pa.

Perforated Metal
Cross Engineering Co., Carbondale, Pa.
Harrington & King Perforating Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
W. Toepfer & Sons Co., Milwaukee, Wis.

Pipe (Dredge, etc.)
R. D. Wood & Co., Philadelphia, Pa.

Portable Conveyors
Austin Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio

Portable Engines
Climax Engineering Co., Clinton, Iowa

Power Units
Climax Engineering Co., Clinton, Iowa

Pulleys
The Hill Clutch Co., Cleveland, Ohio

Pulleys (Magnetic)
C. G. Buchanan Co., New York, N. Y.

Pulverizers
Fuller-Lehigh Co., Fullerton, Pa.
Jeffrey Mfg. Co., Columbus, Ohio
K-B Pulverizer Co., Inc., New York City
Kent Mill Co., Brooklyn, N. Y.
Munson Mill Machinery Co., Utica, N. Y.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Universal Crusher Co., Cedar Rapids, Iowa
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.

Pumps (Sand and Gravel)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
Morris Machine Works, Baldwinsville, N. Y.

Pumps (Water, etc.)
Emerson Pump and Valve Co., Alexandria, Va.
Morris Machine Works, Baldwinsville, N. Y.
Pennsylvania Pump and Compressor Co., Easton, Pa.
Webb City & Carterville Fdy. & Mch. Works, Webb City, Mo.

Rails
Easton Car and Construction Co., Easton, Pa.

Railway Supplies
Atlas Railway Supply Co., Chicago, Ill.

Road Machinery
Acme Road Mchy. Co., Frankfort, N. Y.
Austin-Western Rd. Mchy. Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, Ohio
Koehring Co., Milwaukee, Wis.
Northwest Engineering Co., Chicago, Ill.
Universal Road Mchy. Co., Kingston, N. Y.

Scales (See Weighing Equipment)

Scrapers (Drag, etc.)
Austin-Western Rd. Mchy. Co., Chicago, Ill.
Northwest Eng. Co., Chicago, Ill.
Thomas Elevator Co., Chicago, Ill.

Screens
Acme Road Mchy. Co., Frankfort, N. Y.
Austin-Western Rd. Mchy. Co., Chicago, Ill.
Cleveland Wire Cloth Co., Cleveland, Ohio
Cross Engineering Co., Carbondale, Pa.
Dodge Mfg. Corp., Mishawaka, Ind.
Harrington & King Perforating Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Kennedy-Van Saun Mfg. & Eng. Corp., New York City
Kent Mill Co., Brooklyn, N. Y.
Link-Belt Co., Chicago, Ill.
McLanahan Stone Machine Co., Hollidaysburg, Pa.
Robins Conveying Belt Co., New York City
Smith Engineering Wks., Milwaukee, Wis.
W. Toepfer & Sons Co., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
W. S. Tyler Co., Cleveland, Ohio
United Iron Works, Inc., Kansas City, Mo.
Universal Crusher Co., Cedar Rapids, Iowa
Weller Mfg. Co., Chicago, Ill.
Williams Pat. Crush. & Pulv. Co., St. Louis, Mo.

Screens (Electric Vibrating)
W. S. Tyler Co., Cleveland, Ohio

Separators (Magnetic)
C. G. Buchanan Co., New York, N. Y.
Dings Magnetic Separator Co., Milwaukee, Wis.

Shafting
The Hill Clutch Co., Cleveland, Ohio

Shovels (Steam, Gas and Electric)
Bucyrus Co., S. Milwaukee, Wis.
Erie Steam Shovel Co., Erie, Pa.
Koehring Co., Milwaukee, Wis.
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., Marion, Ohio

Sprockets and Chain
American Manganese Steel Co., Chicago Heights, Ill.
Dodge Mfg. Corp., Mishawaka, Ind.
Jeffrey Mfg. Co., Columbus, Ohio
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

Steel Plate Construction
Hendrick Mfg. Co., Carbondale, Pa.
Jackson & Church Co., Saginaw, Mich.
Steacy-Schmidt Mfg. Co., Philadelphia, Pa.

Testing Sieves and Shakers
W. S. Tyler Co., Cleveland, Ohio

Track Equipment
Central Frog and Switch Co., Cincinnati, Ohio
Easton Car and Construction Co., Easton, Pa.

Tramways (Aerial Wire Rope)
Interstate Equipment Corp., New York City.
A. Leschen & Sons Rope Co., St. Louis, Mo.

Transmission Machinery
Dodge Mfg. Corp., Mishawaka, Ind.
The Hill Clutch Co., Cleveland, Ohio
Kritzer Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

Valves (Throttle)
Emerson Pump and Valve Co., Alexandria, Va.
Knox Mfg. Co., Philadelphia, Pa.

Washers (Sand, Gravel and Stone)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Lewistown Fdy. & Machine Co., Lewistown, Pa.
Link-Belt Co., Chicago, Ill.
McLanahan Stone Machine Co., Hollidaysburg, Pa.
Smith Engineering Works, Milwaukee, Wis.
W. Toepfer & Sons Co., Milwaukee, Wis.

Weighing Equipment
Merrick Scale Mfg. Co., Passaic, N. J.
Richardson Scale Co., Passaic, N. J.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

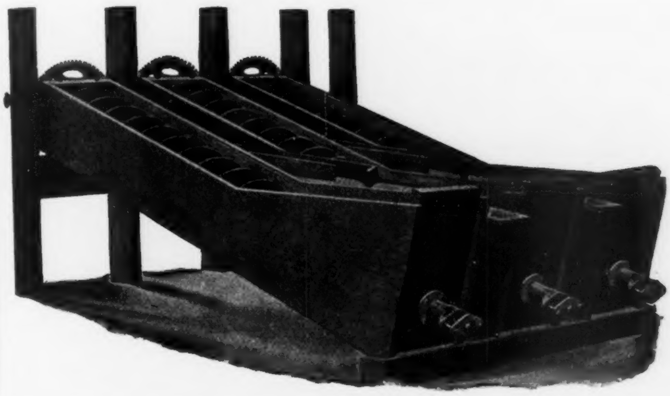
Wheels (Car)
Easton Car and Construction Co., Easton, Pa.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

Wire Cloth
Cleveland Wire Cloth Co., Cleveland, Ohio
W. S. Tyler Co., Cleveland, Ohio

Wire Rope
American Steel & Wire Co., Chicago, Ill.
Armstrong Mfg. Co., Waterloo, Iowa
A. Leschen & Sons Co., St. Louis, Mo.
Williamsport Wire Rope Co., Williamsport, Pa.

Mr. Sand Man!

IF it's clean sand you want to produce and you are unable to do so, write to us and state your trouble and we can help you to solve your problem. We make machinery that produces the cleanest Glass Sand.



The Lewistown Equipment, which includes Crushing, Grinding, Screening, Washing, Drying and Conveying Machinery, will produce more and a better quality of Glass Sand, at a bigger profit than any other equipment on the market.

LEWISTOWN FOUNDRY
& MACHINE COMPANY
Lewistown, Pa.

Guaranteed Haulage

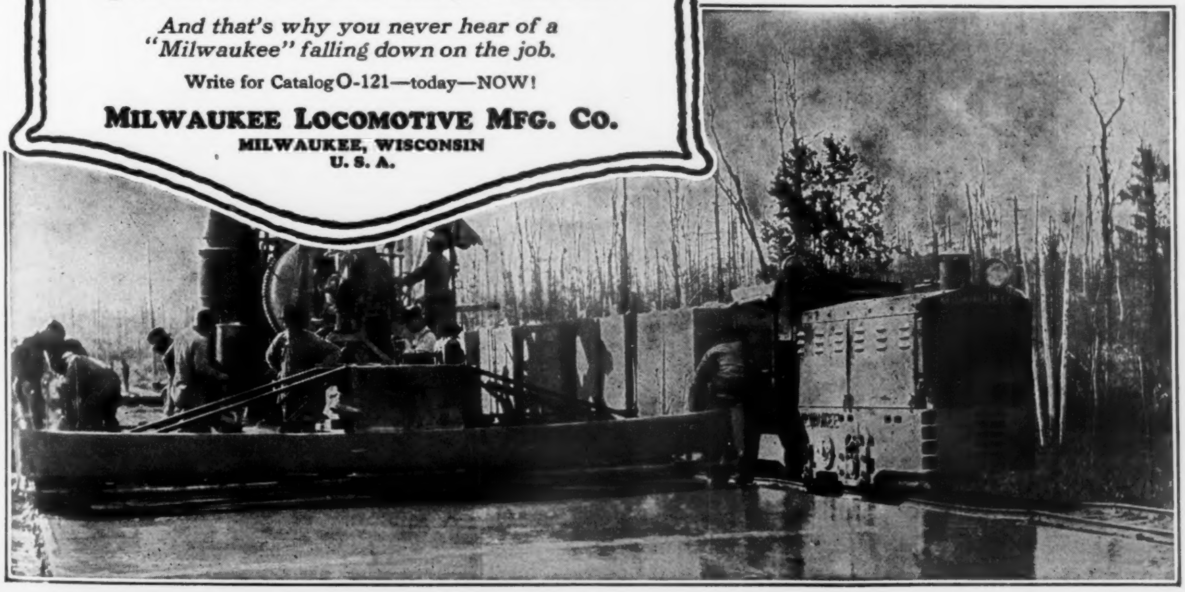
Telling the world about the good qualities, the reliability and economy of Milwaukee Locomotives would mean nothing—if we didn't back up our claims with a *positive guarantee* based on actual performance.

And that's why you never hear of a "Milwaukee" falling down on the job.

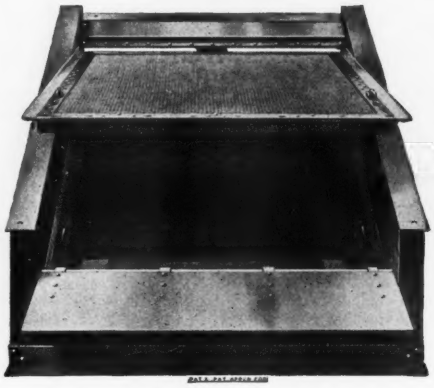
Write for Catalog O-121—today—NOW!

MILWAUKEE LOCOMOTIVE MFG. CO.
MILWAUKEE, WISCONSIN
U. S. A.

MILWAUKEE
GASOLINE
LOCOMOTIVES



Heavy Duty Moto-Vibro Screen



FOR SAND, GRAVEL, CRUSHED STONE, ETC.

Coarse or Fine
1 to 3 Products

WET, DRY, DAMP
(within reasonable limits)

ASTONISHING CAPACITIES

ACCURATE OUTPUTS

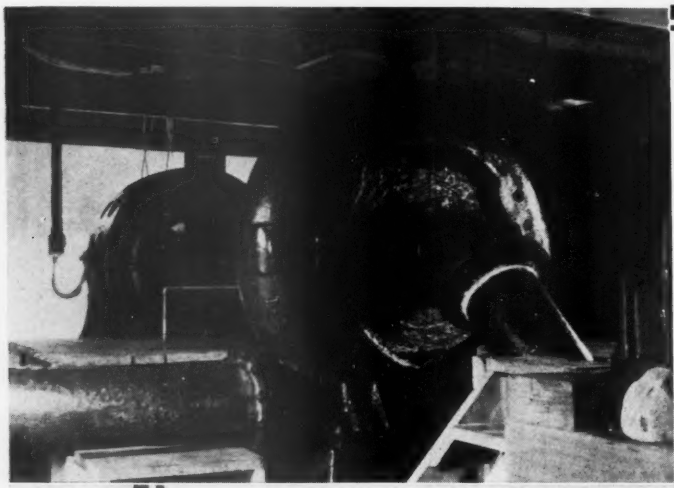
INEXPENSIVE

SCREEN FRAMES CHANGED IN 5 MINUTES—NO SPECIAL CLOTH

Intense vibration separates adhering sand from pebbles, breaks up sand "mats," prevents building on wire, wedging, and keeps meshes open.

Motor or belt driven, no auxiliaries. Simple, durable, accessible.

STURTEVANT MILL CO. HARRISON SQUARE Boston, Mass.



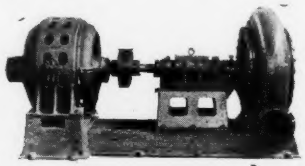
AMSCO

Manganese Steel Pump

at the Springfield-Pekin Gravel Co.

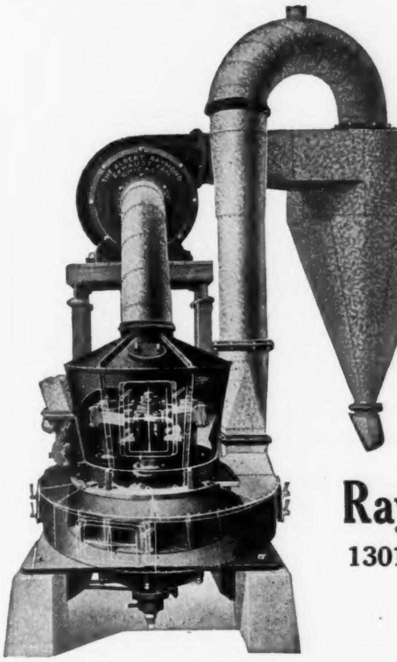
Another 12″ Amsco Sand and Gravel Pump of heavy duty construction, with marine type bearing, successfully producing materials, operating under high head conditions.

Amsco pumps employ rigid, sturdy construction, with simplicity of design. The mechanical parts are of rugged proportions, made to amply carry any loads to which they may be subjected. The aim has been to enable the operator to easily and quickly remove, repair and replace the component parts.



American Manganese Steel Co.
398 E. 14th St. Chicago Heights, Ill.
Foundries: Chicago Heights, Ill.; New Castle, Del., and Oakland, Cal.

Ford Has Six Raymond Roller Mills Grinding Coal For Use in His Large New Boiler Plant



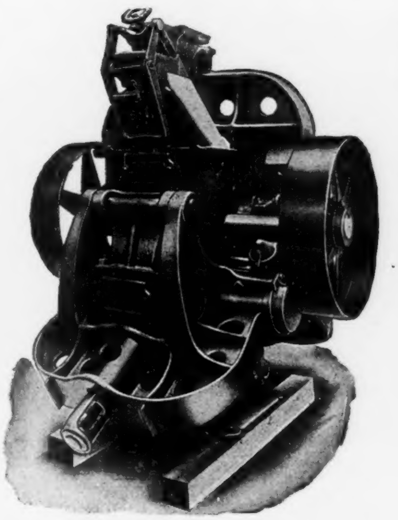
Now, based upon results obtained for a year and a half on these Mills, he will use two more in his new cement plant, besides doubling the capacity of his boiler plant.

Pretty good evidence that Raymond Roller Mills grind coal economically and give continuous day in and day out service.

Raymond Bros. Impact Pulverizer Company

1301 North Branch Street **Chicago, Ill.**

Western Office: 1002 Washington Bldg., Los Angeles, Calif.
Eastern Office: 50 Church St., New York City



MAXECON MILL

For Fine Pulverizing of

Limestone, Gypsum, Phosphate, etc.

EFFICIENT—ECONOMICAL—RELIABLE

PERFECTECON SCREEN SEPARATOR

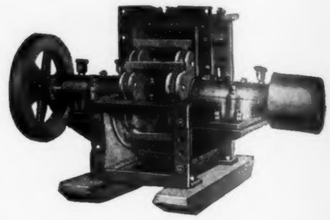
For Large Capacity Screening

Let These Solve Your Cost and Trouble Problems

KENT MILL COMPANY

10 Rapelye Street **Brooklyn, N. Y.**

Buy Your Crushing Equipment on a Cost-Per-Ton-of-Output Basis



Do that—and your choice will inevitably be the K-B Pulverizer, the All-Steel Hammer Mill.

The heavy cast steel frame, and the manganese steel hammers, breaker blocks and lining plates, will outlast any ordinary pulverizer—this means minimum upkeep cost.

And the design of the hammers, and the arrangement of parts, give the maximum pulverizing effect with the minimum of power—this means lowest operating cost.

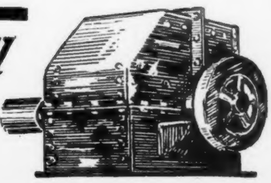
Write for the Catalog

K-B PULVERIZER CORPORATION

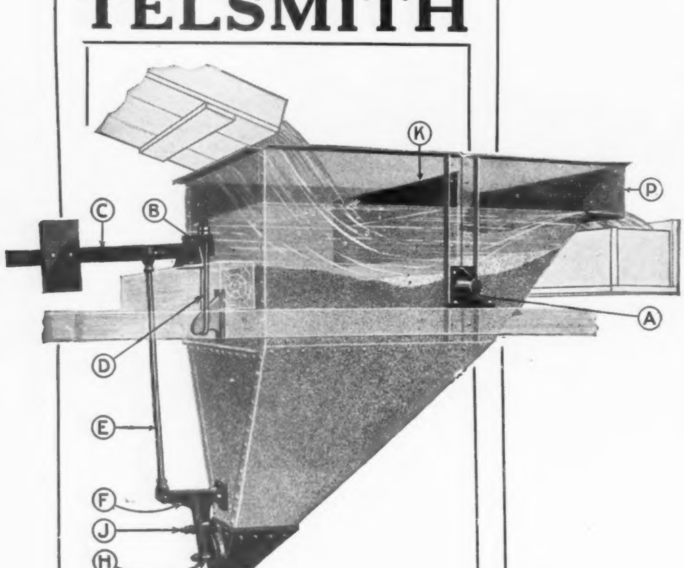
92 Lafayette Street, New York

K-B Pulverizer

The All Steel Hammer Mill



TELSMITH



SAND TANK

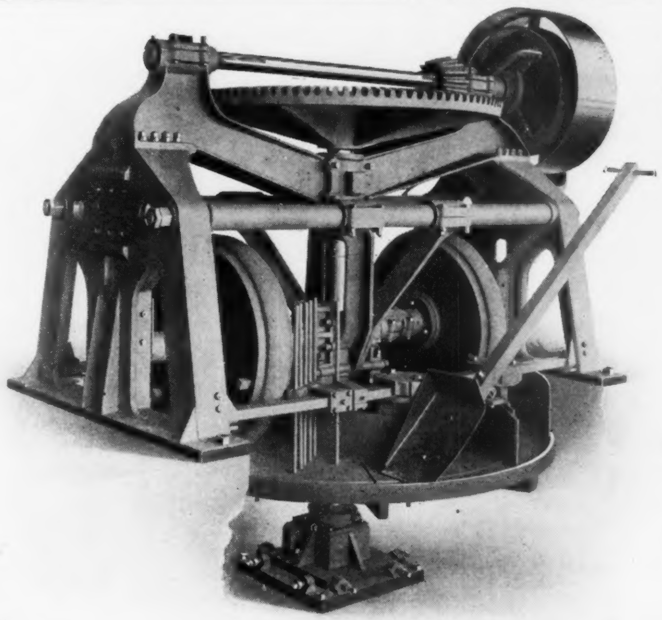
DELIVERS CLEAN DRY SAND—

The Telsmith Sand Tank and its counterweight-arm are both carried on knife-edge bearings, with a wide range of adjustment. As the tank pivots one way, the valve plate pivots in the OPPOSITE DIRECTION, giving ample discharge area with a short, snappy valve action. The movement of both members is short and rapid, discharging the sand in SMALL QUANTITIES but at FREQUENT INTERVALS. This action assures a deep sand-bed and a dry product.

Careful tests under operating conditions show that Telsmith sand contains under 5 per cent free water and a total moisture content under 25 per cent. No other tank dewaters so thoroughly. Send for Bulletin No. ST-11.

SMITH ENGINEERING WORKS

3188 Locust Street **Milwaukee, Wisconsin**



The "SAGINAW" WET PAN

The "Saginaw" 9-foot Wet Pan is heavy, substantial and durable, was designed for the exceptionally trying work of sand-lime brick factories. Operating several sand-lime brick plants and after using the best pans we could buy, decided we would have to end the expense and annoyance of the continual breakdowns by building a pan so designed as to eliminate the weaknesses causing these troubles. The pan shown is the successful result of this decision.

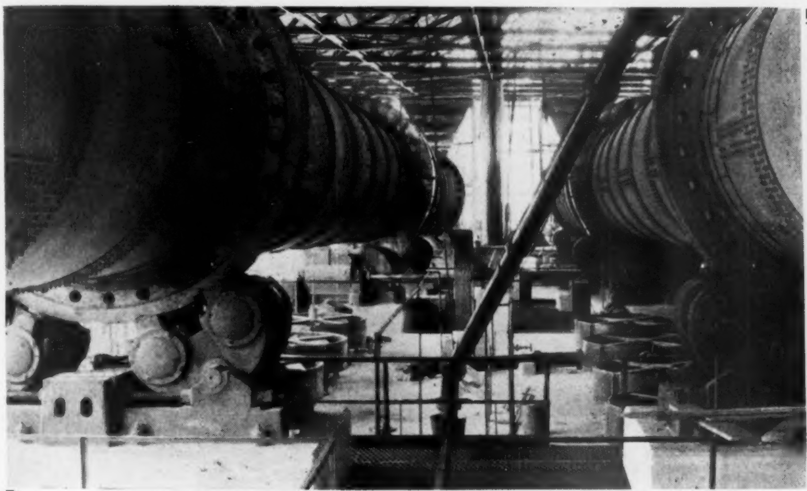
All shafts and bearings are of ample size and bearings are well lubricated. The lower end of the upright shaft has a hardened steel toe of large area, secured in a taper hole in end of shaft, running on a bronze step. The casing has an effective sand and dirt shield, and a side plate allows access for adjustment or replacement.

We also manufacture Hydrators, Kettles, Rod Mills, Wet Pans, Transfer Cars, Turntables, Hardening Cars, Sand Scrapers and Volumeters.

We also design and complete plants.

JACKSON & CHURCH Company

SAND LIME BRICK MACHINERY — SAGINAW, MICH. U. S. A.



VULCAN KILNS

at the

LEHIGH COMPANY'S 16th PLANT

Two of the three 10′ 0″ and 11′ 3″ by 190′ 0″ Vulcan Kilns at the Birmingham, Ala., plant operated by the Lehigh Portland Cement Co.

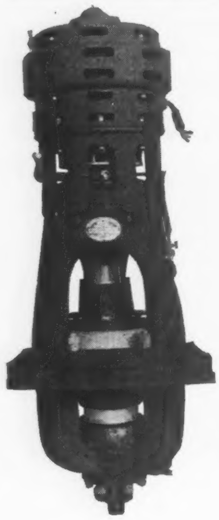
There is a special reason why large organizations, who want value, are turning to the Vulcan in such numbers; and it can be found in the universal realization that the Vulcan Kilns stand out sharply as an example of a super-fine product.

VULCAN IRON WORKS, Est. 1849

1753 Main Street — **Wilkes-Barre, Pa.**

New York: 50 Church Street — **Chicago: McCormick Bldg.**

The Weston Direct Drive Gyratory Crusher for Secondary Reduction of Hard Rock, Ore and Gravel



Developed in a Granite Crushing Plant

This machine fills the need for a secondary crusher of large capacity and great strength for work in all friable rock.

The first machine, installed more than two years ago, has established remarkable records for capacity, low power consumption and general economy in operation. Later installations have more than proved all claims for the machine.

The construction is all-steel with Chrome-Vanadium forged steel shaft of large size, and with full-bearing eccentric, bronze bushed inside and out.

The entire machine is arranged to give freedom from costly delays. Positive lubrication without pumps—Dust prevention in bearings—Greater wear on manganese before replacement—Ease of adjustment and repair—and a sturdy oversize motor—All work to your advantage.

Crusher is simple in design and the best practice in modern Engineering is utilized. Built in six standard sizes to follow any primary, smallest machine can be set to ½" with large capacity.

Arranged for direct motor, or belt drive.

Bulletin No. 25-A describes this machine in detail

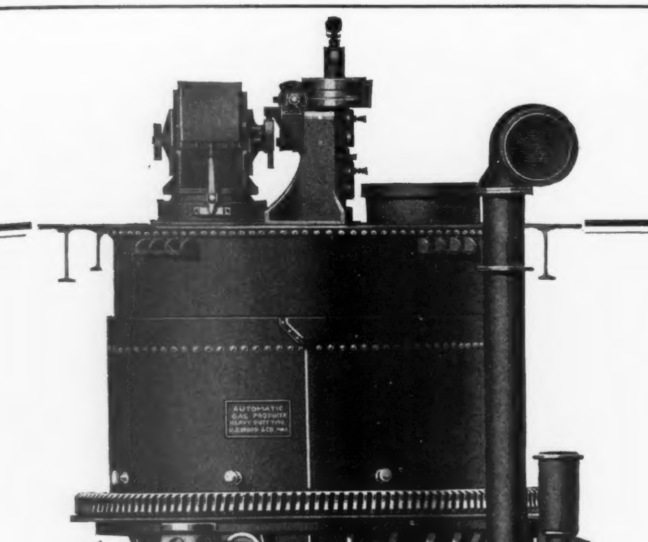
THE MORGAN ENGINEERING COMPANY
ALLIANCE, OHIO

Designers, Manufacturers and Contractors
Electric Traveling Cranes, Rolling Mill Machinery
Ordnance, Steel, Shipbuilding and Forging Plants Complete
Rock Crushers, Special Machinery for Any Purpose

Chicago
122 S. Michigan Ave.

Pittsburgh
1420 Oliver Bldg.
Birmingham, Ala.
Brown-Marx Bldg.

Wood Automatic Gas Producers



For a maximum of uniformly rich gas from a minimum of fuel, and for low labor cost and small maintenance expense the R. D. Wood & Company's Automatic Gas Producers can not be equaled.

The Heavy Duty type gasifies up to 50 tons of coal per 24 hours and the M. C. type up to 30 tons.

Used in leading lime plants. Our catalog tells why. Send for it.

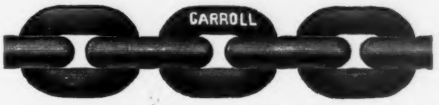
HYDRAULIC MACHINERY AND OPERATING VALVES

R. D. WOOD & CO.
ESTABLISHED 1803
PHILADELPHIA, PA.

CAST IRON PIPE, HYDRANTS AND VALVES

"CARROLL and the TIGER"

The White Rock plant, Martin, Ohio, operated by the Kelly Island Lime and Transport Co., use a 1½-in. Carroll Solid Weld Steam Shovel Chain on a Marion Shovel.



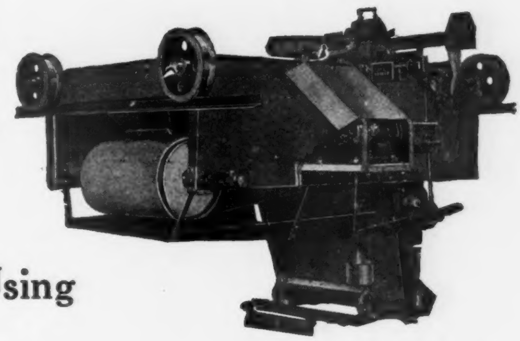
This is the sort of an organization we are proud to serve. It is the sort of organization that buys without fear or favor. They buy on the "Show Me" principle. A product must be able to deliver, must be able to stand up and give a service performance that demonstrates its value, or it is soon thrown into the discard.

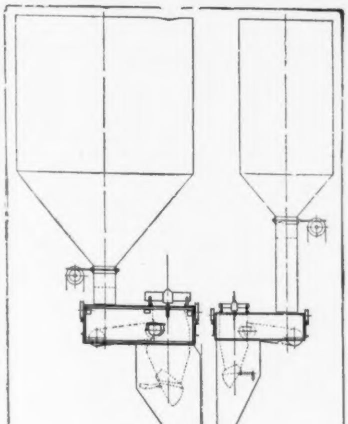
The Kelly Island organization is pleased with the service obtained from the Carroll chain. Satisfied users prove value and all Carroll users are satisfied.

THE CARROLL CHAIN CO., Columbus, Ohio

Coal Fed to Boilers and Kilns in Lime Plants Automatically Checked Against Output of Lime

Secure Better Profits





by Using

Richardson Apron Feed Automatic Scales

Production of finished lime checked against fuel charges helps to improve efficiency, eliminates waste and insures closer and more economical operating control.

RICHARDSON SCALE COMPANY, Passaic, N. J.

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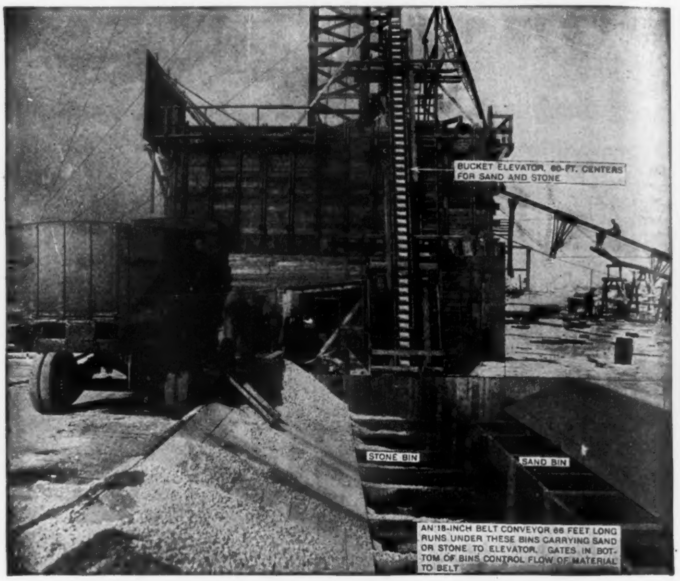
WELLER-MADE EQUIPMENT

For Handling the Materials Mechanically

Increase the Output and Reduce Costs by Employing Weller-Made Machinery to Do the Work

It is sturdy and reliable. Never lays down on the job. The cost of operation is small. Will help pay dividends.



We Make
Conveyors of All Types

Bucket Elevators	Portable Elevators
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Write and let us know the kind of equipment you are interested in or the material you want to handle. Catalogues showing installations, also data to help in selection of equipment, will be sent.

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1820-1856 North Kostner Avenue SALES OFFICES **Chicago, Illinois**

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AN OTTUMWA LOADER

will solve your loading problem. It is the solution of a large part of your man shortage. Put that loading gang on more productive work and let an Ottumwa take their place. It will do it efficiently and economically, will increase your tonnage and profits and reduce your costs.

The Ottumwa is a portable handy belt loader that can be moved around and easily operated on part time by one man. It is mechanically correct and is provided with ball and roller bearings, an improved Alemite Greasing System and a novel raising and lowering device. Protected from dust and dirt and is fool proof.

It will pay you to investigate the Ottumwa Loader.

Backed by 25 Years' Loading Experience

MANUFACTURERS
OTTUMWA BOX CAR LOADER COMPANY, OTTUMWA IOWA.
BEST BOX CAR LOADERS AND UNLOADERS

TELL US YOUR PROBLEM

ENGINEERING SERVICE

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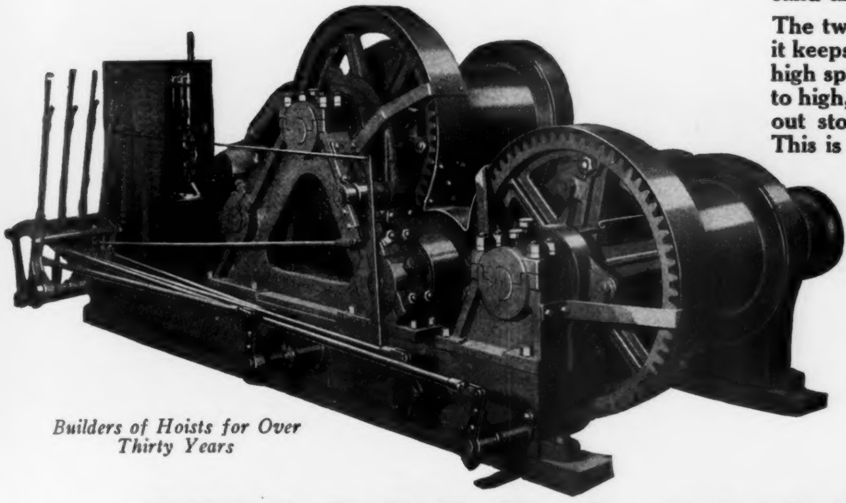
Specialized Hoists for Sand and Gravel

The Thomas Two-Speed Electric Slackline Cableway Hoist is an ideal hoist for sand and gravel.

The two speed device is so designed that it keeps pulling in the slow speed until the high speed takes effect; the shift from low to high, and vice-versa, can be made without stopping the rotation of the drums. This is an exclusive Thomas feature.



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Builders of Hoists for Over Thirty Years

THOMAS HOISTS

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THE HADFIELD-PENFIELD STEEL COMPANY
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and broken promises frequently mean loss of business.
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Let us quote on your requirements.

The Hadfield-Penfield Steel Co.
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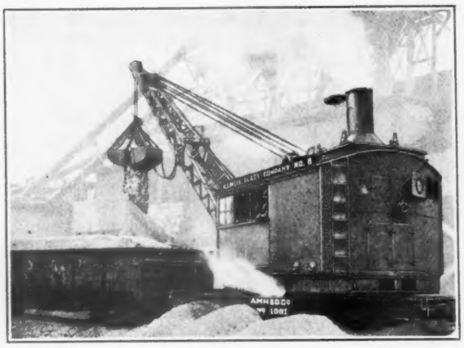

"AMERICAN" Locomotive Crane Owned by Foley Bros. Does Fast Work With Clamshell Bucket

Foley Brothers' "AMERICAN" Locomotive Crane unloaded 3 gondola cars of sand loaded with 170 yards of sand in 60 minutes. Did own switching, which took 20 minutes off the actual 60 and brought the unloading down to 13 minutes and 20 seconds per car. This included cleaning cars by hand after cars were unloaded by clamshell bucket. From the cars to the stock pile the "AMERICAN" had a one-quarter swing.

AMERICAN HOIST & DERRICK CO.
Saint Paul, Minn.
New York - Chicago - Pittsburgh - Seattle - New Orleans - Detroit

Doing the work of 19 men

INDUSTRIAL CRANE

AT THE HUBBELL SAND CO., MANISTEE, MICHIGAN, loading 25 to 30 cars of Lake Michigan blown sand per day, averaging 52 tons per car, with a crew of 6 men.

An INDUSTRIAL can undoubtedly save you many dollars of wages and hours of time.

Let us send you our Golden Anniversary catalog.

Industrial Works, Bay City, Michigan
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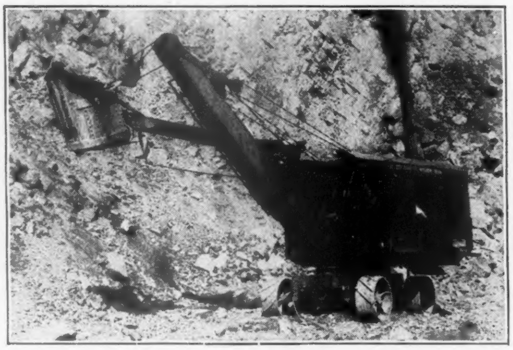
SALES ENGINEERS IN ALL PRINCIPAL CITIES
1873 BUILDERS OF CRANES FOR 50 YEARS 1923



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OSGOOD
Revolving Steam Shovels

Meet every demand for economical and easy operation, speed, long life and faithful service. The inspection of an OSGOOD at work will prove their efficiency.

Our Bulletins will help you to check them up. Yours for the asking.

¾, 1, 1¼ yd. Revolving Steam Shovels, Clamshells, Draglines and Cranes
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The OSGOOD Company
MARION, OHIO, U. S. A.

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In the game of crushed stone quarrying a drill that is within flirting distance with steam shovel or the loading gangs is in a dangerous position. A breakdown on the drill, and the whole production schedule is upset.

No. 14 Cyclone Drills, on the job, always keep plenty of stone ahead, and if they should ever be crowded there is no need for worry—the working parts are cast steel, reducing to the very minimum all possibility of breakdowns.

Write for "Big Blast Hole Drills," a semi-technical treatise on quarry drilling and also containing a complete description of Cyclone No. 14 Big Blast Hole Drills.

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EXPLOSIVES
for quarrying

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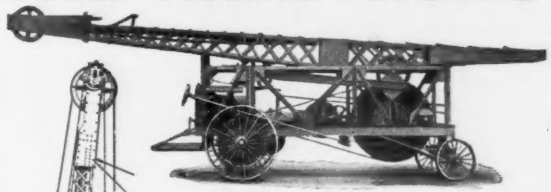
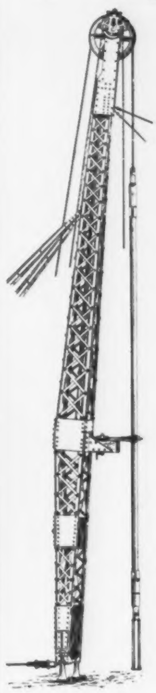
THE ARMSTRONG





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The ideal revolving shovel for quarry service and gravel pits—

1½ to 2 cubic yard dippers, depending on character of material to be handled.

Built with a strength and power to give steady service with the least possible maintenance.

The only revolving shovel of this size equipped with a locomotive boiler.

Readily equipped as a dragline excavator, clamshell excavator or crane.

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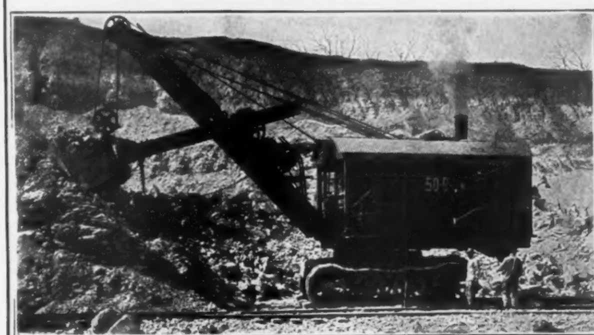

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Davenport Locomotives give long and satisfactory service under all sorts of difficult operating conditions, and over rough and uneven tracks. They are efficient, economical, durable; and will take care of your cars as fast as they can be loaded.

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Baldwin Industrial Locomotives Can Be Depended Upon

When a big contract is to be completed by a certain date; when the sugar harvest must be transported in record time; when the logs must be brought down to the mills; in fact, wherever motive power is required to keep the work going, Baldwin industrial locomotives can be depended upon to render satisfactory service.

And even though your locomotive requirements are most unusual, there is a Baldwin design that will meet them successfully.

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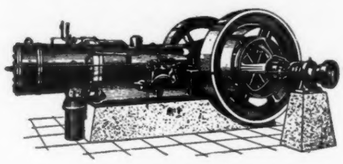
Power for ½ cost per H. P. hr. is obtained in Quarries where the PRIMM is installed. If you are paying more for your power, write us for further information and the EVIDENCE.



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EASTON QUARRY CARS

TYPE 5462

EASTON CAR & CONSTRUCTION CO.
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"QUARRY CAR PRACTICE"
Issued every now and then

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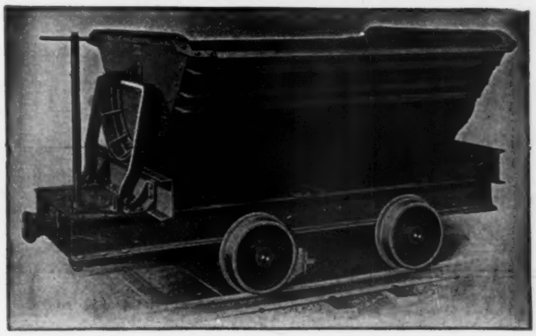

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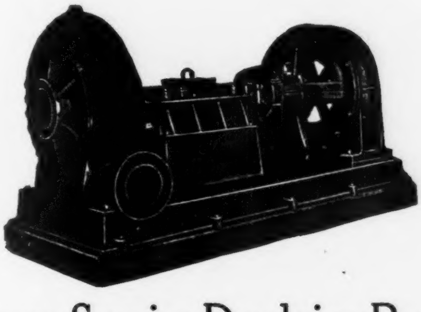
Reinforcing a dump car makes it stronger, of course. But there is a best way to reinforce. Atlas cars are reinforced the best way. Why? Simply because we have built dump cars so long and for so many people that we know just where the reinforcing should go and just how it should be done.

Not much wonder, then, that Atlas dump cars stand the "gaff" better than the average.

The Atlas Car & Manufacturing Co.
ENGINEERS MANUFACTURERS
CLEVELAND, OHIO, U. S. A.



Heavy Service Dredging Pump

Where conditions are too severe for our standard sand pump, the above type is recommended.

It is built in sizes from 4 in. up, arranged for belt, motor, or engine drive.

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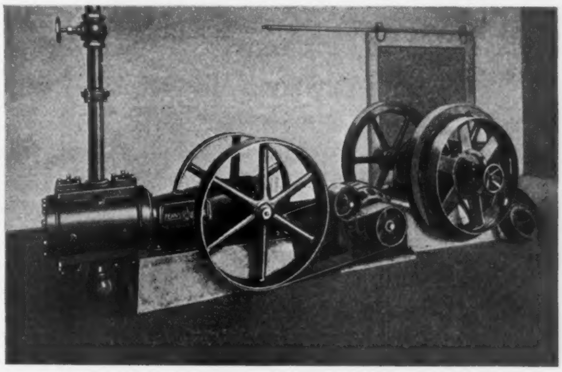
Bulletin No. 19-B fully describes our complete line of sand and dredging pumps. Have you your copy?

MORRIS

Since the Civil War Builders of Centrifugal Pumps, Hydraulic Dredges, and Steam Engines



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Our Nearest Branch Will Forward Descriptive Literature on Request

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Design and build cement plants, rock crushing plants, power plants and industrial structures.

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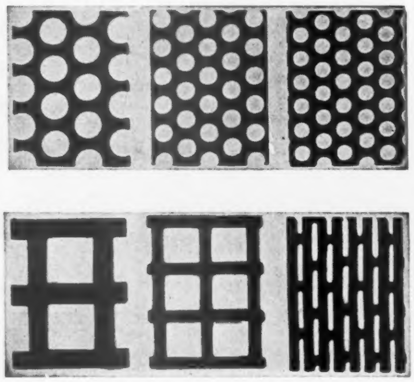

For Screening Stone, Gravel, Sand and Cement

All sizes and shapes of holes in metal of proper thicknesses to give the best screening results.

Sheets furnished flat or rolled to shape for revolving screens.

THE HARRINGTON & KING PERFORATING CO.

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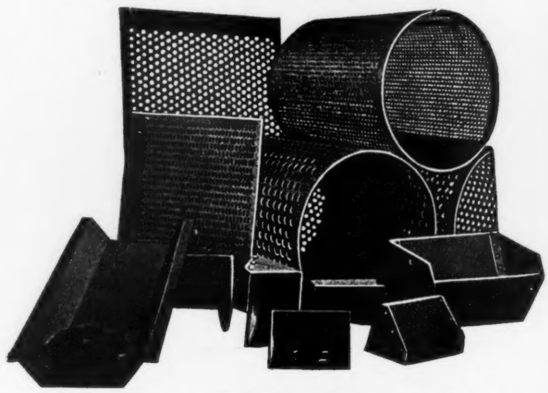
Perforated Metal Screens
FOR
Stone, Gravel, Sand, Etc.



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PLAIN AND PERFORATED

General Sheet and Light Structural Work
"Light and Heavy Steel Plate Construction"

HENDRICK MFG. CO.
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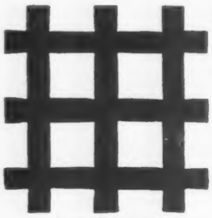
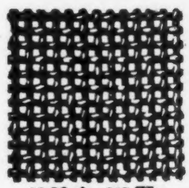
"CLEVELAND" DOUBLE CRIMPED WIRE CLOTH



2½ mesh; .105 wire

A uniform fineness is assured by the use of "Cleveland" Double Crimped Wire Cloth, making it unequalled for the screening of Sand, Gravel, Crushed Stone and Cement. "Service" is the definite policy of this organization, and through every phase of manufacture this end is constantly before us.

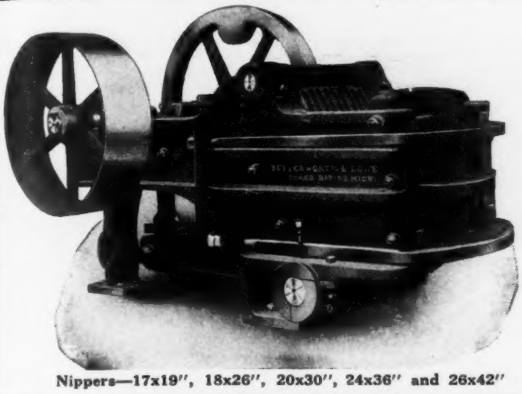
A large stock always on hand. However, any special mesh will be manufactured to suit requirements. PRICES RIGHT



18 Mesh; .047 Wire

THE CLEVELAND WIRE CLOTH AND MANUFACTURING COMPANY

3573 East 78th Street **Cleveland, Ohio**



Nippers—17x19", 18x26", 20x30", 24x36" and 26x42"

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For All Rocks and Ores Softer Than Granite

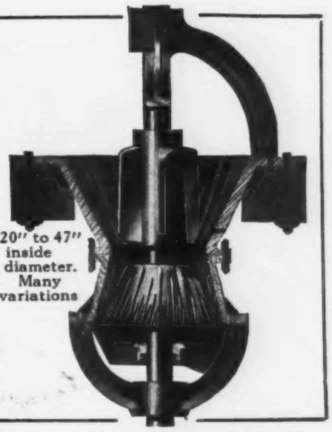
GYPSUM MACHINERY—We design modern Plaster Mills and make all necessary Machinery, including Kettles, Nippers, Crackers, Buhrs, Screens, Elevators, Shafting, etc.

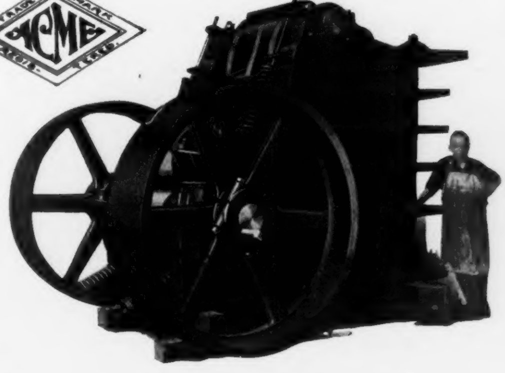
Special Crusher-Grinders for Lime

Butterworth & Lowe

17 Huron St. Grand Rapids, Mich.

20" to 47" inside diameter. Many variations





Acme Steel Crushers

6x10 to 42x48

We have in stock for immediate delivery sizes up to 30x36, one piece frame, and up to 26x40, four piece frame.

Diecast Genuine Removable Bearings

Complete Quarry Equipment
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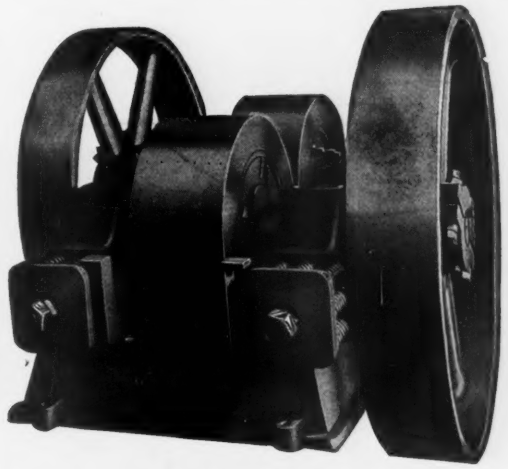
Main Office and Factory
Frankfort, N. Y., U. S. A.



CRUSHERS—

Webb City & Carterville crushers, screens, elevator buckets, or transmission equipment have conspicuously demonstrated their superiority wherever they have been installed.

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WEBB CITY, MISSOURI

The Kritzer Continuous Lime Hydrator

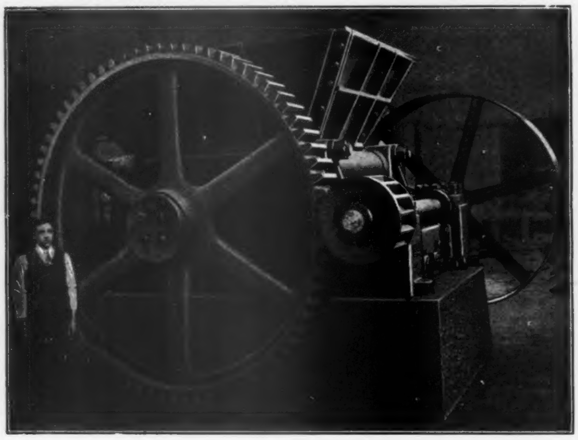
HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

THE KRITZER COMPANY
503 South Jefferson Street CHICAGO, ILL.



If you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher, you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.

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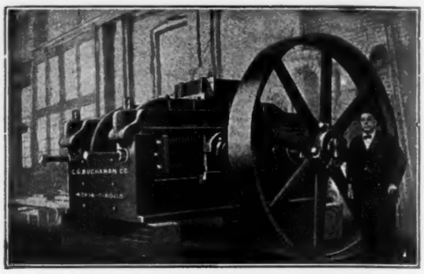
Screens, Elevators, Conveyors, Rock Washers, Etc.

BUCHANAN CRUSHING ROLLS



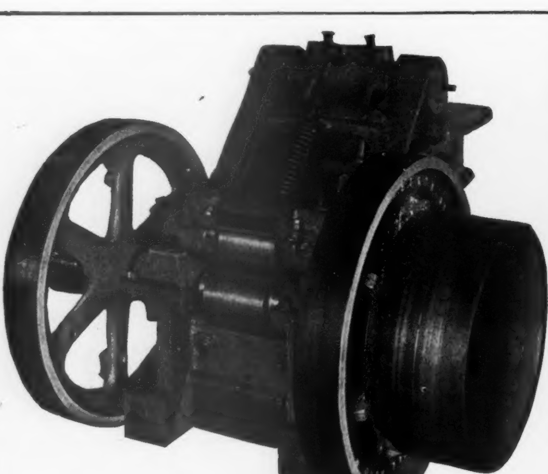
Type "C" Buchanan Box Bed Crushing Rolls for Heavy Duty
Bulletin No. 13

Years of manufacturing experience, combined with an intimate knowledge of the conditions under which such machines operate, assures the purchaser of Buchanan Equipment machines of remarkable durability.

COMPLETE CRUSHING PLANTS

C. G. BUCHANAN CO., Inc.

Cedar and West Streets NEW YORK CITY



Reliance Crushers

IN ALL SIZES FOR EITHER PORTABLE PLANTS FOR ROAD BUILDING OR STATIONARY QUARRY INSTALLATIONS.

BUILT FOR LONG, HARD SERVICE—WILL SAVE YOU MONEY IN THE LONG RUN

Let us quote you prices

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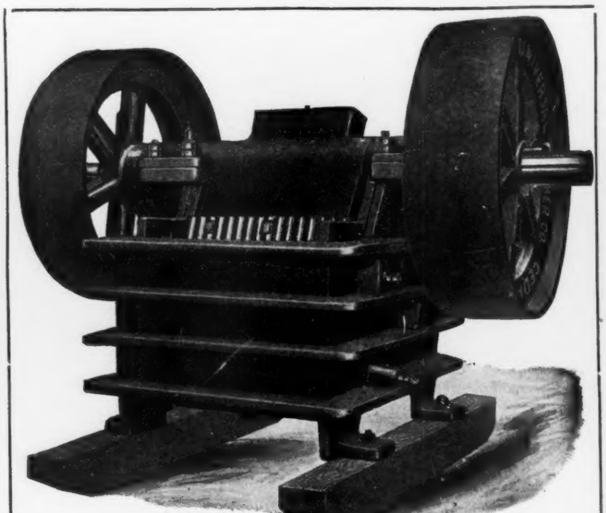
Branches in all principal cities in U. S. and Canada

MANUFACTURERS OF THE FAMOUS RELIANCE LINE OF ROAD BUILDING AND QUARRY EQUIPMENT



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THE PERFECT GRAVEL AND REJECTION CRUSHER

Sizes up to 8"x36". Capacities 20 to 200 tons daily. Crushes to ¾" and finer if desired. Has no superior for FINE CRUSHING and UNIFORMITY of product.

STRONG LIGHT DURABLE ECONOMICAL

UNIVERSAL CRUSHER CO.

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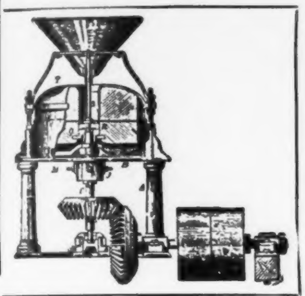
Do You Do Fine Grinding?

THE Munson Underrunner Buhr Mill has stood the test of time and is still first choice with a large number of concerns whose product demands fine, uniform grinding.



This mill is particularly well adapted for grinding limestone, gypsum, hematite ores, slate and similar materials, though in actual service is is used on a much wider variety of products.

Send us a sample of the material you wish ground so that we may tell you the possibilities of the "MUNSON."

Catalog No. 71 tells more about these mills.

Munson Mill Machinery Co., Inc.
Est. 1825 **Utica, N. Y.**

YORK LIME KILNS

Special Kilns For Special Purposes

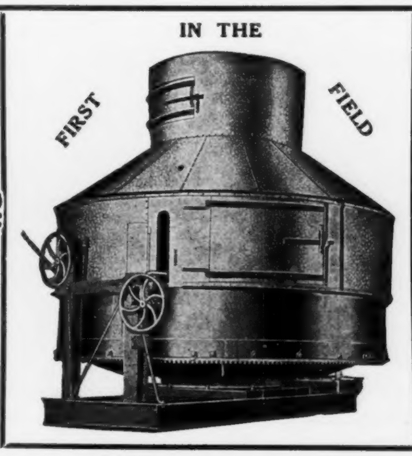
We also manufacture:
- Dryers
- Hydrators
- Gas Producers
- Rotary Screens
- Tanks
- Grey Iron Castings
- Special Machinery from Engineers' Designs

Keeping up with progress in the lime industry does not necessarily mean the scrapping of your present plant.

We fit our modern kilns between old-style kilns so as not to conflict with old plant arrangements. In keeping with this idea, we are modernizing the plant of the Cheshire Lime Co., Cheshire, Mass., in just this way.

Working in co-operation with the foremost lime and hydrating engineers in the country enables us to achieve efficiency and economy.

McGann Manufacturing Company, Inc.
Works, York, Pa.
332 S. Michigan Ave., Chicago 50 Church St., New York



THE CLYDE LIME HYDRATOR

Patented Nov. 29, 1921—Serial No. 1398238

The Clyde was first in the field, and through dependable and economical performance is still first choice of lime operators.

The Clyde Hydrator produces big capacities of lime at only three-fifths the cost of any other hydrator on the market.

Simple, easiest to operate and most economical in cost of installation, maintenance and operation.

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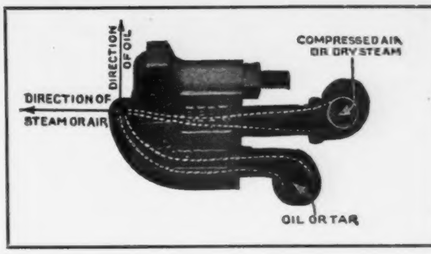
CALOREX LIQUID FUEL EQUIPMENT

"Trade-Mark Registered U. S. Pat. Off."

For Lime and Cement Kilns, boilers or any steam equipment.

This diagram shows how the fuel is broken up.



Every drop of oil coming from this burner is broken up. There is no soot or smoke to reduce the heat efficiency; in fact, this equipment is the most efficient and economical solution of the fuel problem and is well worth investigating.

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W. N. Best Corp.
11 Broadway **New York City, N. Y.**

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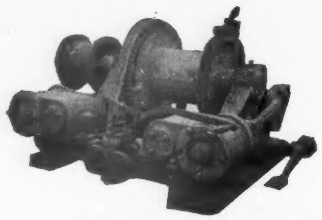

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DOUBLE CYLINDER, SINGLE DRUM, IN FIRST CLASS CONDITION

$125.00 Each F. O. B. Chicago

Capacity, 10,000 Pounds
IMMEDIATE SHIPMENT

Detailed Specifications Furnished on Application
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Relaying rails and angle bars, all weights and tonnages, for prompt shipment. Get our quotations

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(Without Power)

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This conveyor, with its troughed belt and absence of skirtboards makes it possible to handle sand, gravel, crushed stone, and other abrasive materials without damage to the edges of the belt.

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What are Your Hauling Costs?

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Automatic Aerial Tramway

An uninterrupted haul, regardless of weather, to railroad or crusher, a ONE MAN job, no stopping for loading and discharge, operated by gravity or with power.

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Crushing Rolls.
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Sprockets, Traction Wheels, and Roll Heads.
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Heat Insulation

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Sil-O-Cel Insulation possesses a lower heat conductivity than any other known material and will withstand extremely high temperatures. Furnished in convenient forms for easy application.

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McMYLER-

buckets

clam-shell and orange peel

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Equipment for Moving Materials

THE McMYLER-INTERSTATE Co.
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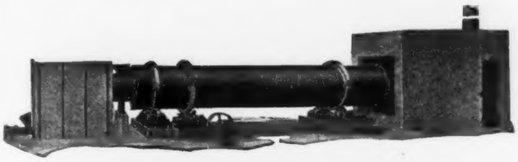
BUCKEYE



DRYERS

Buckeye Dryers are not made to a standard design—simply a set of steel plates riveted together. Every dryer is designed and constructed to meet the conditions they must work under.

It is only by this method that efficiency can be assured, and we believe we are justified in our claim that the Buckeye is the "most efficient Dryer on the market."

Send for catalog

THE BUCKEYE DRYER COMPANY
131 West Lake Street, Chicago, Ill.

CROSS ENGINEERING CO. CARBONDALE, PA. PERFORATED SHEET METALS CE

Our screens produce a product clean and perfectly sized.

We can supply repair and renewal parts quickly and correctly. Rush orders can be filled promptly because of our stock of 500 tons or more of steel plates.

Cross Engineering Company
Offices and Works:
Carbondale, Pa.

End crusher breakage

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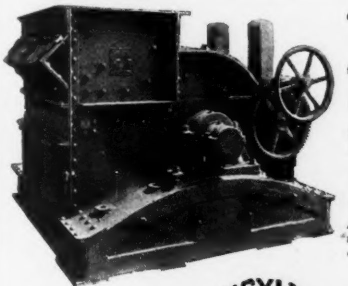
You can't keep iron out of rock. At some stage it enters—bolts, nuts, tie rods, muleshoes. Then if it doesn't do damage to the crusher, you're lucky.

No, you can't keep iron out of rock—but Dings Magnetic Pulleys will keep it out of crushers. No breakage—no repairs—no shutdowns. *Ask for the bulletin.*

Dings Magnetic Separator Company
803 Smith Street, Milwaukee



"PENNSYLVANIA" CRUSHERS

for Limestone, Cement Rock, Shale, Lime, etc.

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New Holland Rock Crushers will crush oversize from gravel banks or from larger crushing plants into finer grades, thus securing highest prices. They are durable and inexpensive and run on small power with little attention. Built in sizes from 2 to 15 tons per hour, requiring 5 to 15 h.p. to operate.

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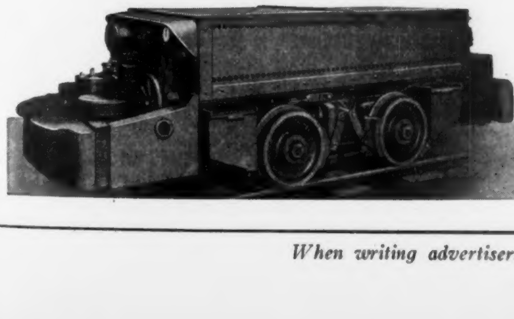
Manufactured by
New Holland Machine Co., New Holland, Pa., U. S. A.

THE IRONTON STORAGE BATTERY LOCOMOTIVE

Efficient, economical hauling. Find out about storage battery locomotives for your hauling. The Ironton is the best storage battery locomotive.

The Ironton Engine Co.
Ironton, Ohio



When in the market for machinery or equipment, look through the advertisements of ROCK PRODUCTS. If you do not find what you want advertised in this issue, write us and we will put you in touch with reliable firms who can supply your need. This service is free to our readers. Use it.

Rock Products

The Nation's Business Magazine of the Rock Products Industry

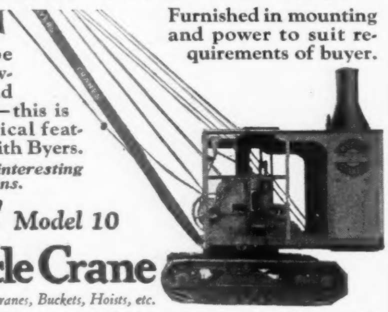
542 So. Dearborn St. Chicago, Illinois

Get a Practical Crane

Furnished in mounting and power to suit requirements of buyer.

BOOM can be raised or lowered under load while operating—this is one of the practical features, exclusive with Byers.

Write us for interesting bulletins.



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Full Circle Crane

Also Auto-Cranes, Truckranes, Buckets, Hoists, etc.

THE BYERS MACHINE COMPANY, 310 Sycamore St., Ravenna, O.

O. S. Dependable

O. S. Dependable Cranes are practical tangible assets in the modern non-metallic mineral plant.

Let us send you proof of their economy and efficiency.

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For Mortar, Cement and Brick—
Brown, Black, Red and Buff
—Strongest and Most Durable

Manufactured by

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They Insure Full Power Transmission

They Sustain the Belt's Full Strength

They Make Good Belts give Better Service

CRESCENT BELT FASTENER CO.
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By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all minerals.

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Drilling Contractors
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BULL BEARING ALLOY

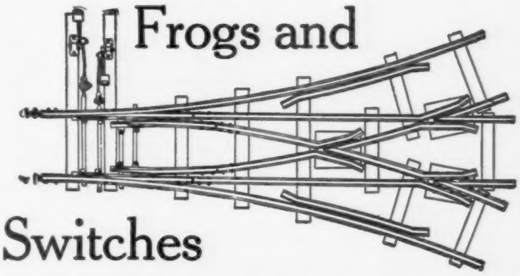
"Better than Babbitt"

Ajax Bull Bearing Alloy in your crusher bearings prevents frequent re-babbitting and is a safeguard against costly breakdowns. We'll prove it.

Send for circular A and our offer.

The Ajax Metal Company, Philadelphia
Established 1880
New York Chicago Boston Cleveland

Frogs and Switches



The Central Frog & Switch Co., Cincinnati, O.

Frogs, Switches, Crossings, Switch Stands, Rails, Angle Bars, Fish Plates, Throws, Rail Braces, Tie Plates, Portable Track, Etc., Etc.

The Morgan Producer Gas Machine

is the highest class gas producer built in the U. S. and is advertised in this journal the second issue of each month.

Morgan Construction Company
Worcester, Mass.

W. D. Mount, 601 Peoples National Bank Bldg., Lynchburg, Va., Representative in the Lime Industry

ROBERT W. HUNT CO.

Inspection—Tests—Consultation

Inspection New and Second Hand Machinery, Pumps, Crushers, Steam Shovels, Cars, Locomotives, Rails and Quarry and Contractors' Equipment

INSPECTION AND TESTS OF SAND, GRAVEL, CEMENT, STRUCTURAL STEEL, CASTINGS AND CONSTRUCTION MATERIALS

Cement, Chemical and Physical Testing Laboratories

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2200 Insurance Exchange
New York **Pittsburgh**
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Scientifically Designed Equipment

Zepp Automatic Hydrator
Meade Improved Lime Kilns
Complete Lime, Cement and Plaster Plants

Efficiency of Operation—Low First Cost

RICHARD K. MEADE & CO.
Chemical and Industrial Engineers
11 E. Fayette St. Baltimore, Md.

Weigh While in Transit Over

THE MERRICK CONVEYOR WEIGHTOMETER

An Automatic—Continuous—Accurate Record

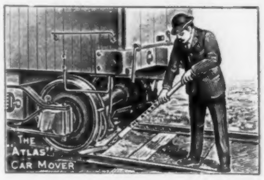
Any material which is conveyor-handled can be weighed without additional handling or loss of time by the Merrick Conveyor Weightometer.

Scales guaranteed and proven better than 99% accurate.

Shipped as a complete unit. Fits any conveyor. Simple to install.

MERRICK SCALE MFG. COMPANY
Passaic, N. J.

ATLAS CAR MOVER



State what style rail to be used on. We will then know what style to send you.

The Atlas Car Mover will move a car farther at a stroke and with less effort than any other car mover on the market.

They save time and money. You cannot afford to be without a few.

Write for Prices Today

ATLAS RAILWAY SUPPLY CO.
431 South Dearborn Street Chicago, Ill.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Type ads only. No cuts or illustrations permitted unless at the regular display advertising rates. Please send check with order. These ads must be paid for in advance of insertion

We Want to Purchase

One 200 H.P. Semi-Diesel Oil Engine, direct connected to a 200 K.W. Generator, 3 phase, 60 cycle, 220 or 240 volts.

EQUIPMENT SALES COMPANY
Nashville, Tenn.

"Wire us your requirements at our expense"
"If we don't have it we will get it"

GASOLINE LOCOMOTIVES

2—6 ton Whitcomb, 24-in. gauge
1—4½ ton Milwaukee, 24-in. gauge
1—5 ton Whitcomb, 24-in. gauge
1—3 ton Whitcomb, 36-in. gauge
1—5 ton Whitcomb, 36-in. gauge

MACHINERY & SUPPLY CORPORATION
Dept. 44
Joplin, Missouri

ROTARY DRYERS

30 New Direct-Fired Rotary Dryers, 4'-0" diam., 30'-0" long. These Dryers were about to be put into operation as the armistice was signed, and consequently were never used. We are offering them at a sacrifice, complete with driving mechanism, furnace irons, grates, etc. Some are equipped with steam radiators, for steam heated air drying.

McDERMOTT BROS. CO.
Allentown, Penna.

FOR SALE

Two—150 H.P. General Electric induction motors, voltage 440, 60 cycle, 3 phase.
15 H.P. Westinghouse, 60 cycle, 3 phase, 220 volt motor.
Williams Number 9.
Universal type hammer pulverizer complete.
Williams No. 3 hammer mill complete.
Sturtevant No. 0 rotary fine crusher complete.
Jeffrey No. 2 limestone pulverizer on trucks with elevator.

Address E. W. Cooper
174 Third Ave. North Nashville, Tenn.

FOR SALE

5—Standard Keystone Lime Kilns, capacity 10 ton; practically new
1—No. 1 Williams swing hammer mill crusher—practically new
1—No. 3 new Williams swing hammer mill crusher, with automatic feeder; new, never used
12—All steel, end dump quarry cars, 42-in. gauge; 7 new, 5 slightly used
A number of steel hopper bins and supports
Priced to move quickly

Clinchfield Portland Cement Corp.
Kingsport, Tennessee

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25', 3½ x25', 4x30', 5½x50', 6x60' and 7x60'; double shell dryers, 4x20', 5x30' and 6x35'; steam-heated air rotary dryers, 4x30' and 6x30'.

KILNS—Rotary kilns, 4x40', 5x50' and 6x70', 6x100', 7x80' and 8x110'.

MILLS—6x8', 6x5', 5x4', 3x3½' pebble and ball mills; 3' March mill; 42", 33" and 24" Fuller-Lehigh mills; 4½x20', 5x11', 5x20', 5½x22' and 6x20' tube mills; 7½x13", 9x15", 16x10" and 12x26" jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 24", 36" and 40" cage mills; 3' and 4½', 6' and 8' Hardinge mills; 18x12", 20x12" and 30x10" roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 5 roll and 2 roll No. 1 and No. 000, No. 00 and No. 0 Raymond mills; one No. 3 and No. 4 and No. 7½ Telsmith breaker; one 36" Sturtevant emery mill; one 3 roll Griffin mill; 60" chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; 6x8', 6x5' and 4x3' Newaygo vibrating screens; Richardson automatic scales; 8' and 10' Emerick air separators.

Air compressors.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

1—59-ton standard gauge American 6-wheel Switcher
1—50-ton standard gauge Shay geared locomotive
1—28-ton standard gauge Shay geared locomotive
1—10x16 in., 36 in. gauge, 4-wheel saddle tank
1—30-ton McMyler bucket-handling locomotive crane
1—14-B Bucyrus Steam Shovel, mounted on traction wheels
10—miles 30 and 35 pound relay steel rails, Canton, Mississippi.

Birmingham Rail & Locomotive Co.
Birmingham, Ala.

SPECIAL BARGAINS

Send Us Your Boiler Inquiries

66x86 in. TRAYLOR JAW CRUSHING PLANT
Model 221 and 250 MARION SHOVELS
Nos. 4-5-6-7½-9 and 10 CRUSHERS
6 and 10-ton Gasoline Locomotives
2-DISC CRUSHERS, 36 in. SYMONS, also 24 in.
100-ton, 2½ yd. ELECTRIC SHOVEL
50—5,000 ft. steam belt and electric compressors
13x30 in.; 10x18 in.; 8x14 in. JAW CRUSHERS—also 24x36 in. Traylor
24x54, 18x30 McLANAHAN ROLL CRUSHERS
50 H. P., D. D. Hoist, 440 V., 3 phase motor, Dragline Set. Also 25 h.p. Dragline Equipment
3—60 h.p. GASOLINE HOISTS, single drum
10 and 12-ton ROAD ROLLERS
5—7½ and 10 h.p. PORTABLE CONVEYORS
750-1000 gpm. Underwriters Steam and Motor Driven Centrifugal Pumps, 220-440 V., 60 Cy., 3 Ph.
100 h.p. Portable Boiler—125-150 lbs., $600.

Ross Power Equipment Co.
Indianapolis, Ind.

WANTED

60 to 75 H. P. Oil Engine
42 to 52 Fuller-Lehigh Mill
Rotary Dryer, 6 ton per hour capacity
State lowest price and name location. All must be in A-1 condition.

FLORIDA LIME COMPANY
Ocala, Florida

FOR SALE

Locomotive Cranes

1—10 Ton, 4 Wheel BROWNING
1—20 Ton, 8 Wheel BROWNING
Standard Gauge—Prompt Delivery

F. William Stocker Hoboken, N. J.

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

Used Equipment

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FOR SALE

4000 lin. ft., 30-in., 20 lb. Track
12 30-in., 1½-yd. Cars
PLYMOUTH GASOLINE LOCOMOTIVE

F. WILLIAM STOCKER
Hoboken, N. J.

FOR SALE

8—6x115-ft. Vulcan Rotary Kilns; condition A-1; unused.
3—4x23-ft. Hersey Dryers.

Address
Box 1700, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Mine Cars, Rails and Locomotives

We have a number of good, serviceable, standard gauge, second hand locomotives, and narrow gauged ones, for immediate shipment.

M. K. FRANK
Frick Building Pittsburgh, Pa.

FOR SALE

No. 18 Universal Pulverizer—Replaced by larger machine, 90% new with 1¼-in., ¾-in. and ⅜-in. Grate Bars. Price $650 F.O.B. plant. Immediate delivery.

LEESBURG SLICA SAND COMPANY
New Castle, Pa.

For Sale—Steam Shovels

1—70 C. Bucyrus, 2½ yd. Bucket.
1—60 Marion, 2½ yd. Bucket.
Both standard gauge. Immediate shipment.

Consolidated Products Co., Inc.
15 Park Row New York, N. Y.

FOR SALE

No. 18 Universal Pulverizer. New machine. Has never been in operation. Immediate shipment. Address

Box 1707, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

FOR SALE

No. 20 Traylor Bulldog Gyratory Crusher
7½D—Gates Gyratory Crusher
No. 10 McCully Gyratory Crusher

ARTHUR S. PARTRIDGE
415 Pine St. Louis

For Sale—STEAM SHOVEL

⅝ YD. THEW "O" TRACTION

Thoroughly rebuilt; attractive terms for quick sale.

Walter A. Zelnicker Supply Co., St. Louis
Rails, Locomotives, Cars, Tanks, Pipe

WANTED

To exchange 70C Bucyrus Shovel for Caterpillar about half size. Address

WIGHT & COMPANY
Box 1775 Richmond, Va.

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Rates for advertising in the Classified Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Type ads only. No cuts or illustrations permitted unless at the regular display advertising rates. Please send check with order. These ads must be paid for in advance of insertion

FOR SALE

One late up-to-date Double Unit S. A. Screening Plant Complete with Washers, Motors, Sub-structure, and ready to dismantle, re-assemble and operate. Nearly new. First class. A genuine bargain. For full description and detail information on prices, etc., address

Box 1706, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Owner of well equipped rock crushing plant and riprap quarry in the southwest, unlimited supply of good stone, large crushing capacity, well located, good established business, but owing to other interests can give the plant but little attention except in an advisory capacity, wants energetic, experienced quarry man with little capital to take over the plant on a desirable basis. Only those capable of handling such a proposition need answer. Address

Box 1702, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Position Wanted

Thoroughly experienced operator wishes to become connected permanently with large reliable firm quarrying and crushing, either hard or soft rock. Location immaterial. Permanency with future main essential. Address

Box 1695, Care of Rock Products
542 South Dearborn Street Chicago, Illinois

Experienced Manager

Open pit or underground quarry superintendent or manager open for employment. Fifteen years' experience. Best references. Nominal salary with share in profits produced.

Address Box 1678, care of Rock Products
542 South Dearborn Street Chicago, Illinois

Will sell cheap 33 tons new Danish flint grinding pebbles size B. Great Western Portland Cement Co., 310 Rialto Bldg., Kansas City, Mo.

WANTED

Good machinist familiar with crushing and grinding machine. Apply

Clifford L. Miller
West Stockbridge Massachusetts

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

You Can Depend On a Shay

Answering an inquiry from a third party regarding his experience with Shay Geared Locomotives, the General Manager of a large company replied:

"* * * Several years ago we purchased one of these locomotives (Shay Geared Locomotives) from the Lima Locomotive Works, and we have used this continuously since that time. The engine has always given satisfaction and is always in working order."

The well-built ruggedness of the Shay is one of its greatest advantages in quarry and excavating service. You can depend on a Shay day in and day out for years.

Write for information about the Shay and its other advantages—geared driving wheels, flexible shaft, light weight, hauling power on grades and ability to work on curves and track that derail a rod engine.

LIMA LOCOMOTIVE WORKS, Incorporated
Lima, Ohio 17 East 42nd Street, New York

LIMA *Shay Geared* LOCOMOTIVES

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There's Extra Wear Built Into Every Indestructible Conveyor Belt

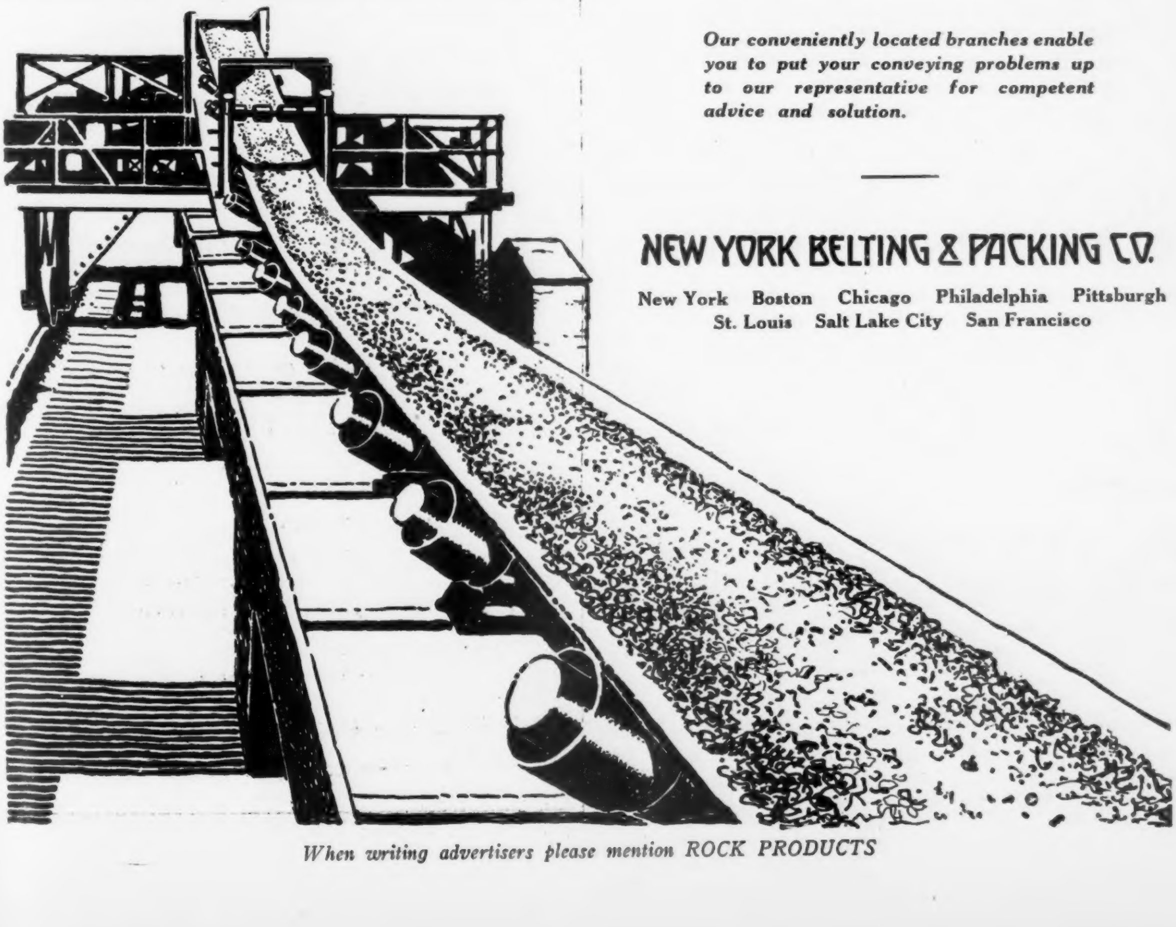
Rubber Goods for the Rock Products Industry

Indestructible Conveyor Belting
Inspiration Elevator Belting
Test Special Transmission Belting
Indestructible Air Drill Hose
Indestructible Water Hose
Indestructible Steam Hose
Firo Superheat Sheet Packing
Indestructible Sheet Packing
Cobbs Piston Packing
Pump Valves

It's the plus wear that counts—the wear beyond the ordinary length of useful life you expect of a conveyor belt. Extra tonnage carried over and above what may be reasonably efficient service, is the true test.

The thorough knowledge of quarrying conditions that enters into the planning of every Indestructible belt results in a type of wear-defying construction that comes through the test of heavy conveying work with cost figures well on the credit side.

The correct weight and kind of duck in the right number of plies, bonded with a tenacious rubber friction and amply protected by a properly resistant rubber cover—these go to make up a conveyor belt possessing inherent quality.



Our conveniently located branches enable you to put your conveying problems up to our representative for competent advice and solution.

NEW YORK BELTING & PACKING CO.

New York Boston Chicago Philadelphia Pittsburgh
St. Louis Salt Lake City San Francisco

The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Entered as second-class matter, July 2, 1907, at the Chicago, Illinois, Postoffice, under the Act of March 3, 1879.

Published Every Other Saturday by

Tradepress Publishing Corporation

542 South Dearborn Street, Chicago, Illinois

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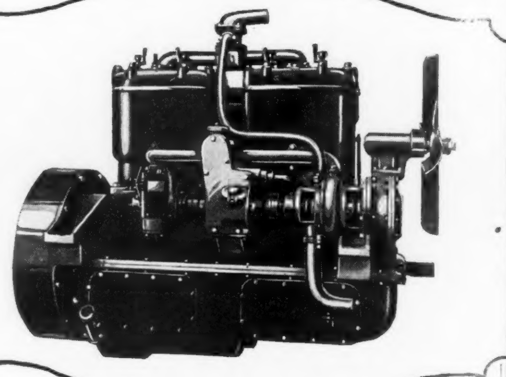

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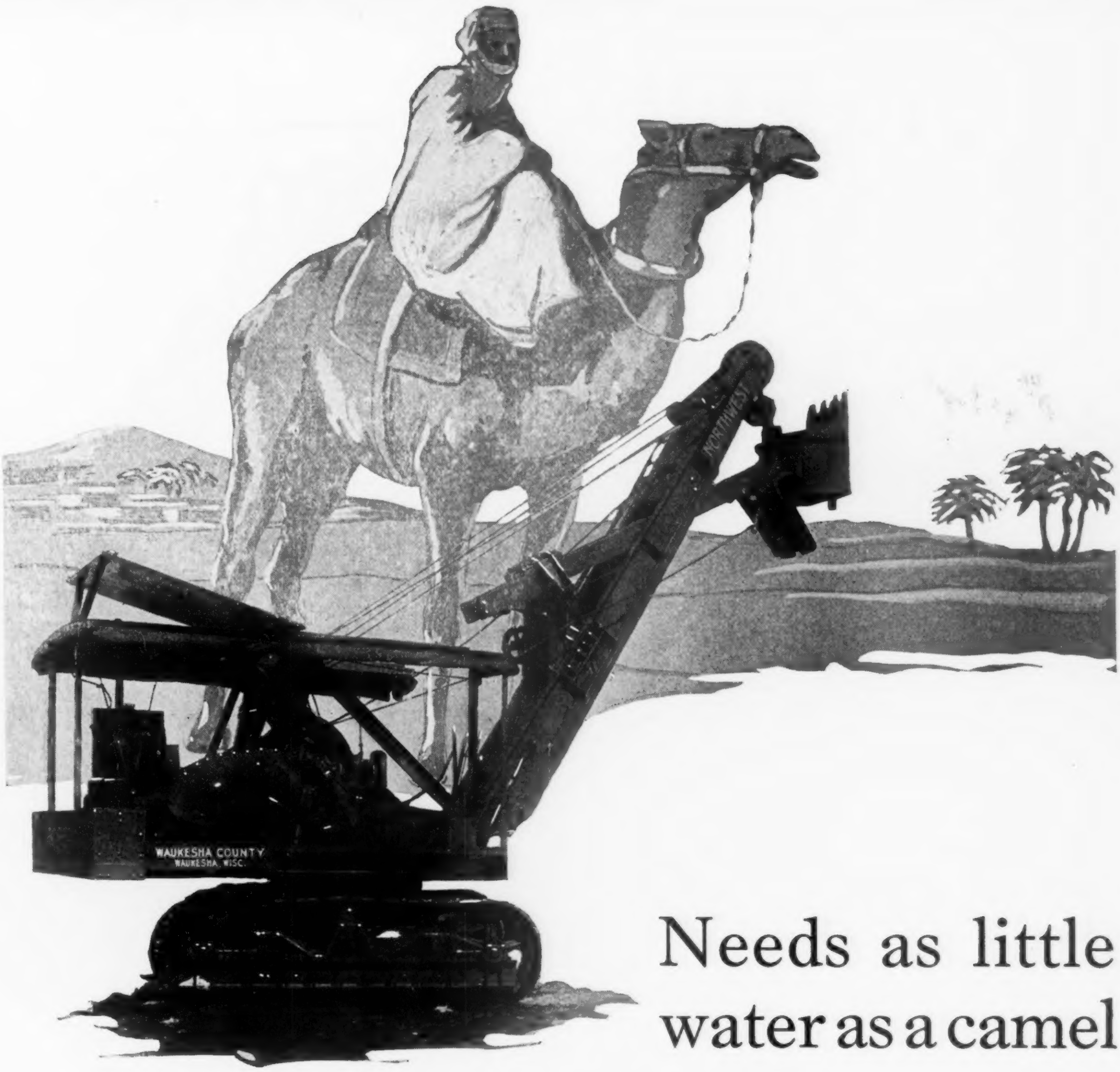

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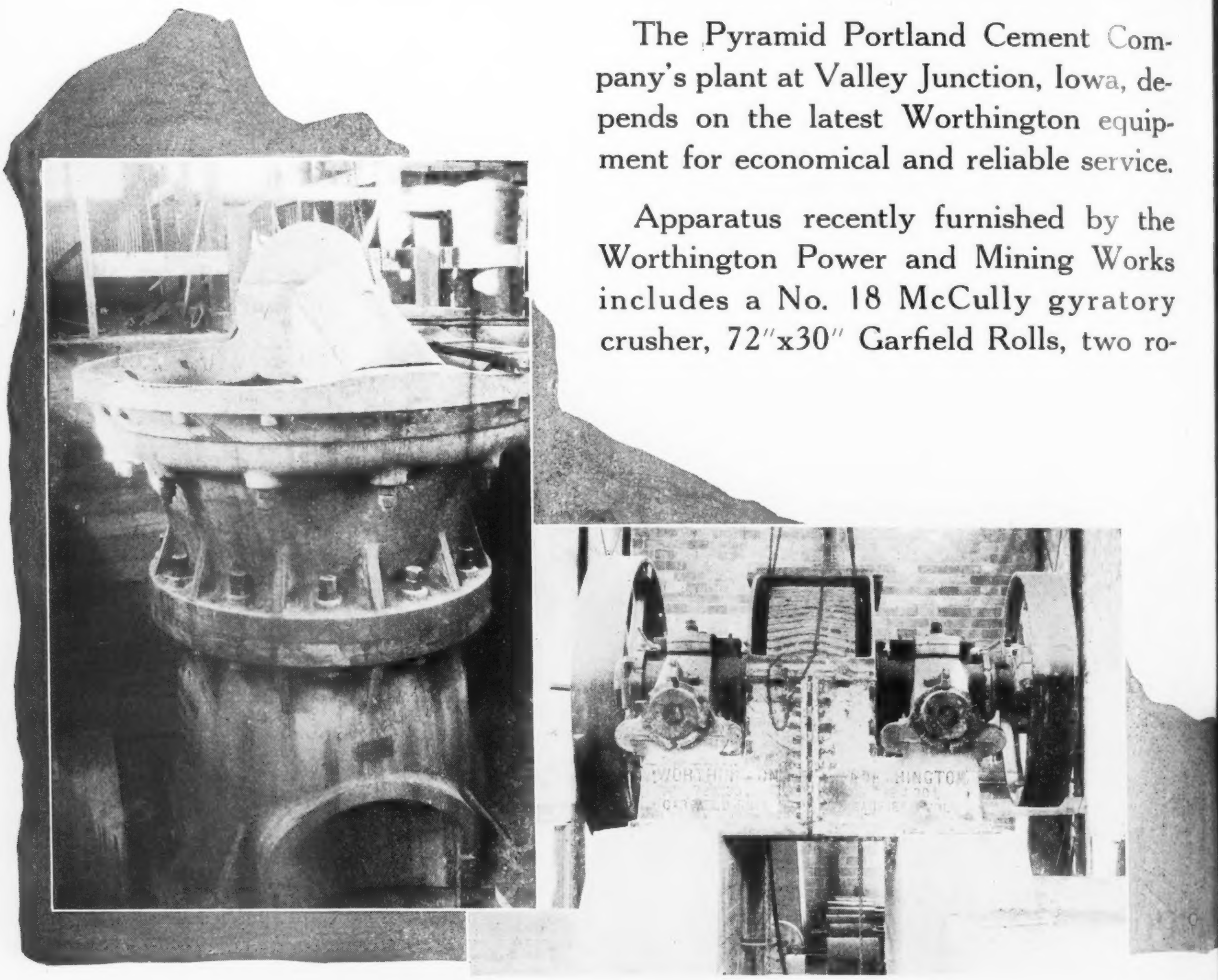

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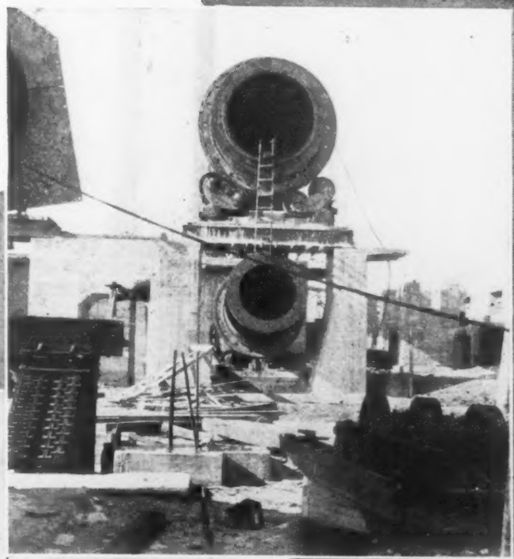

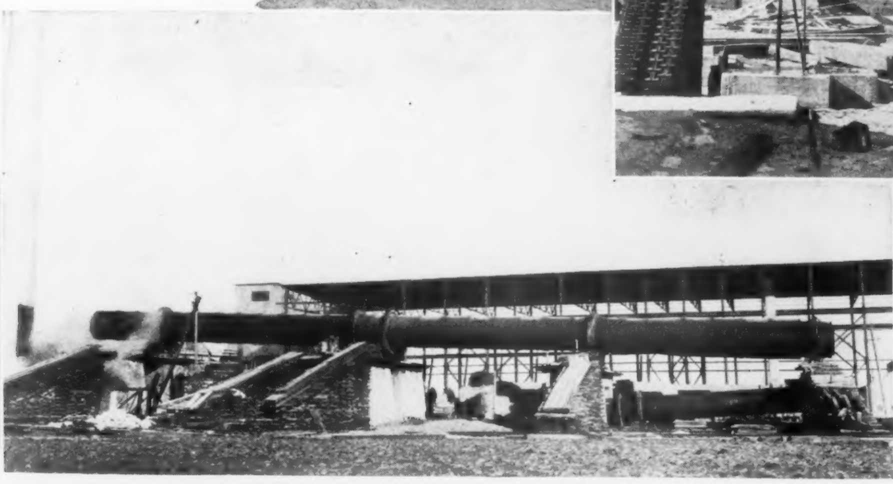

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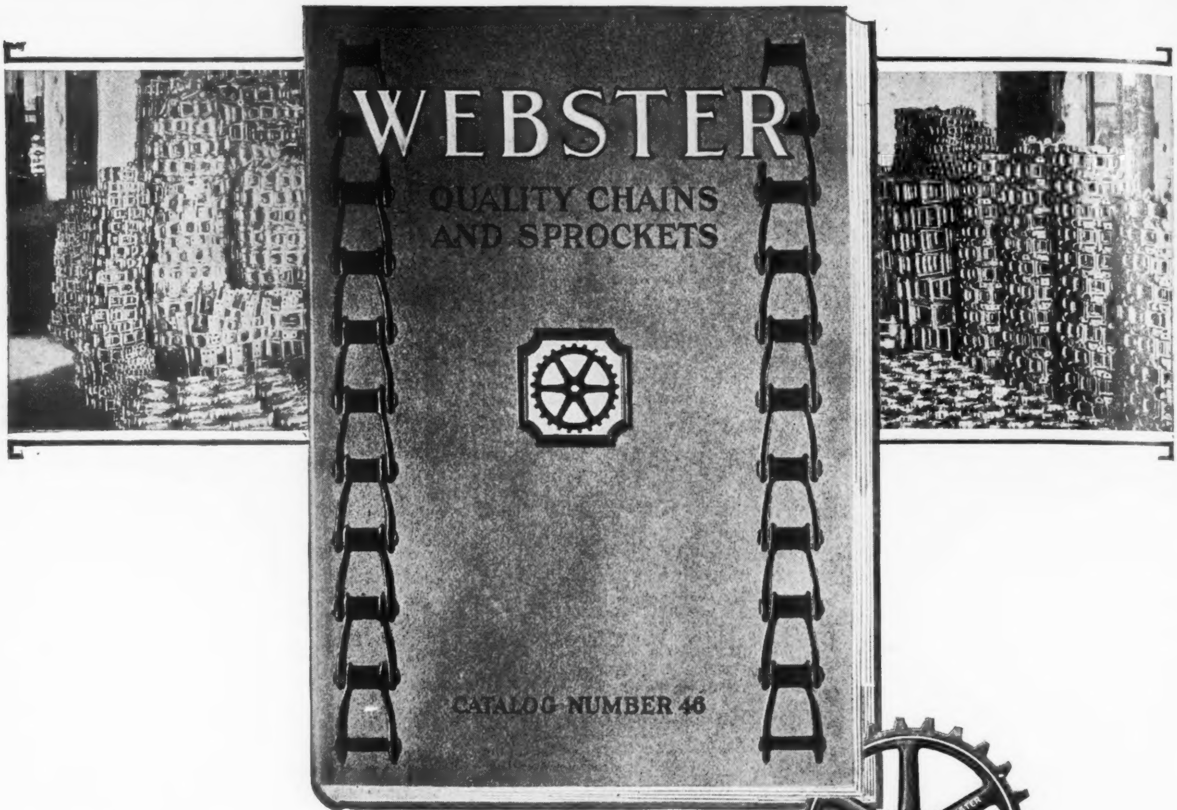

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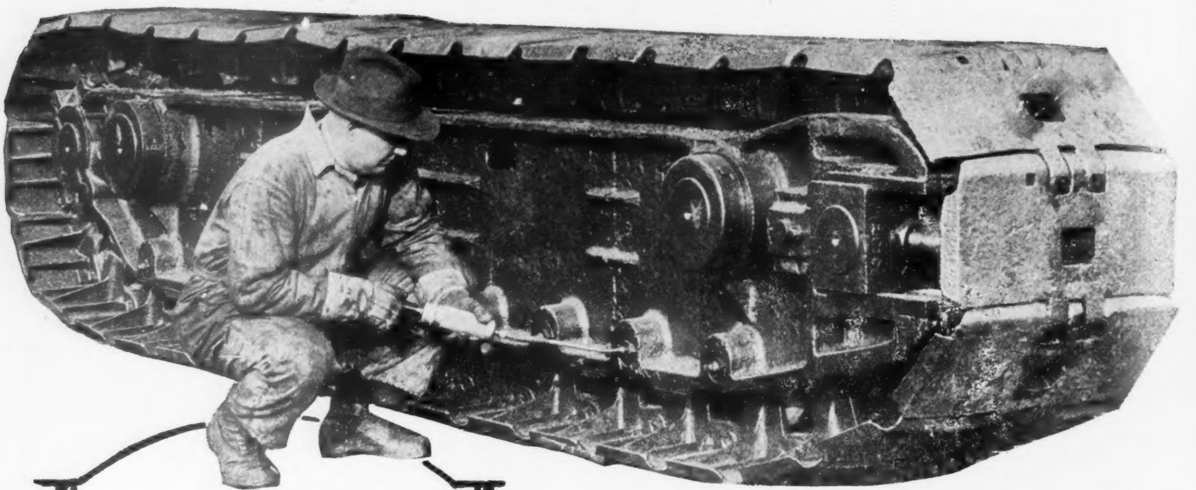

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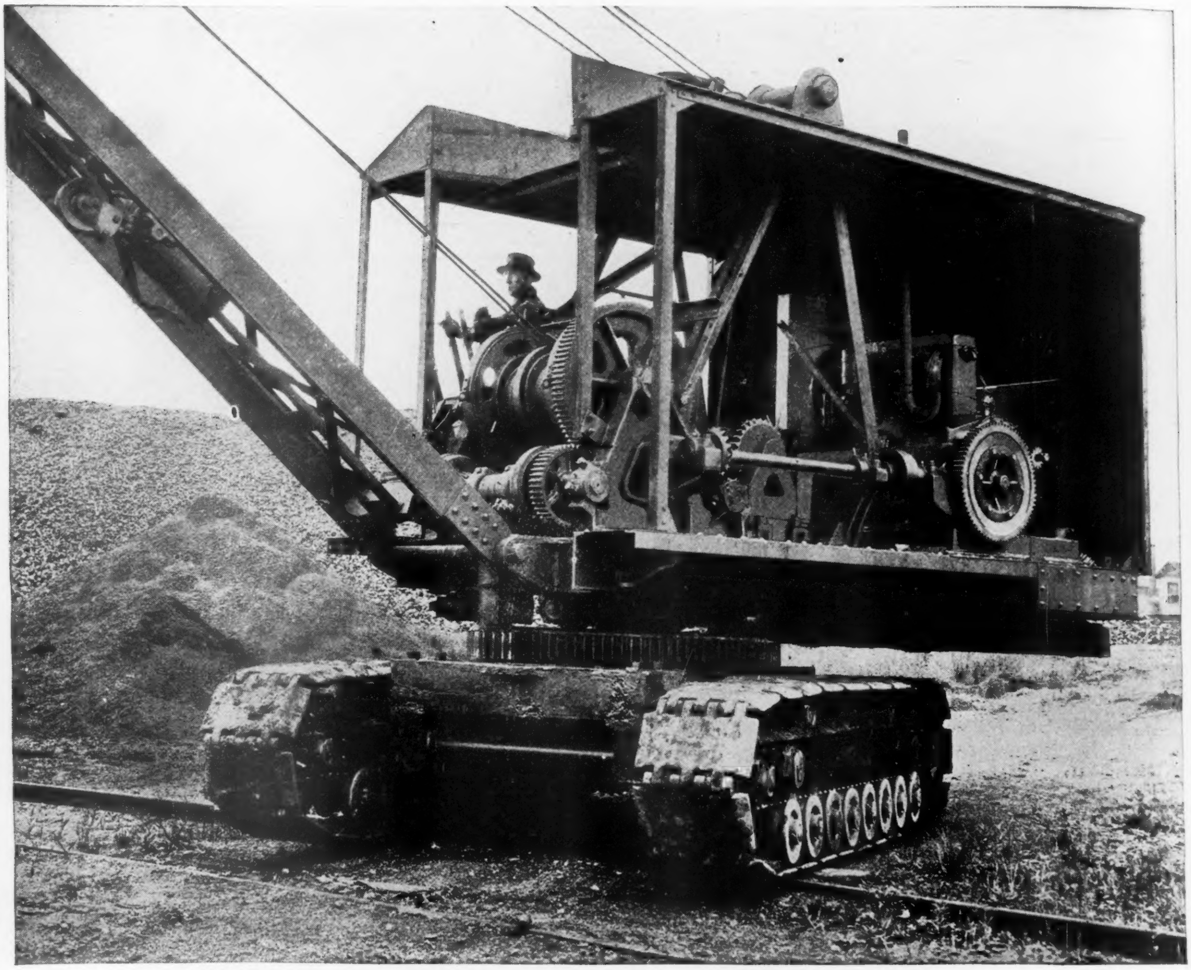

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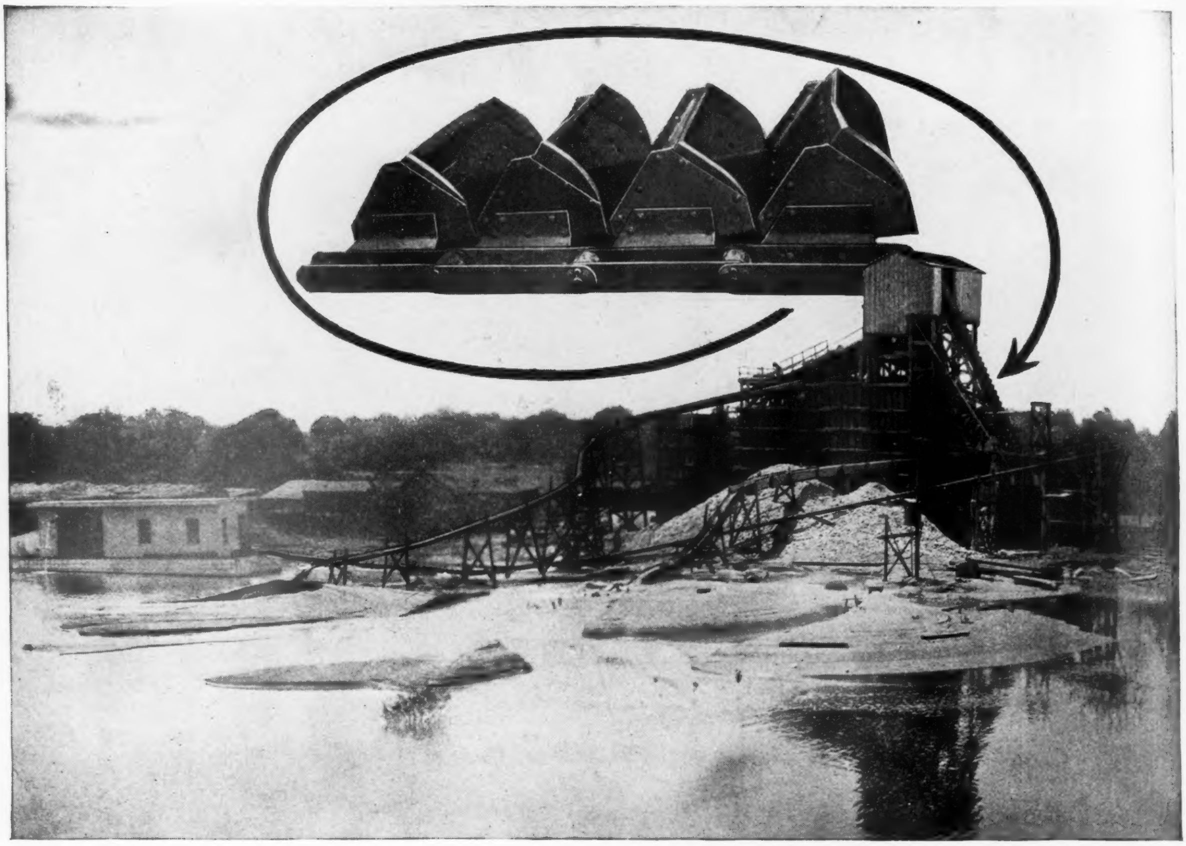

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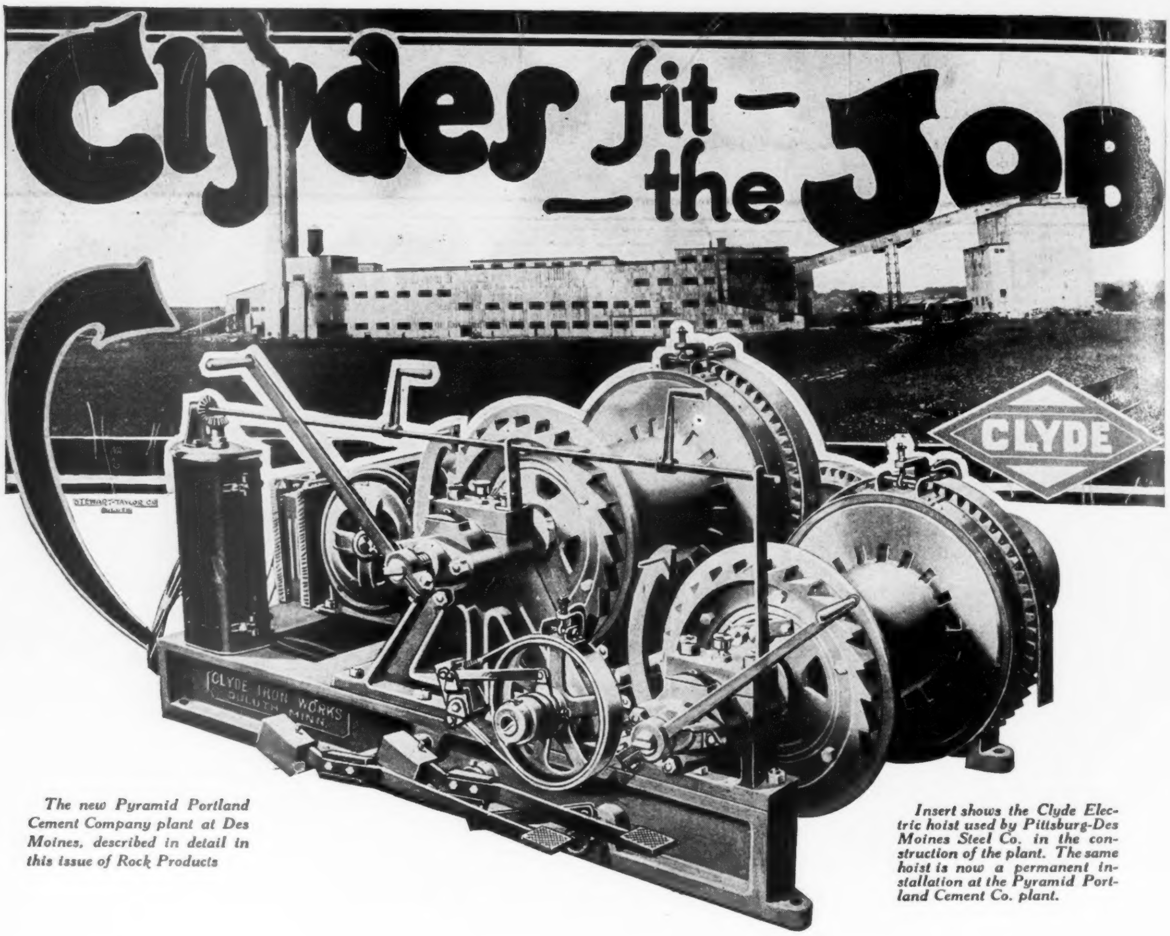

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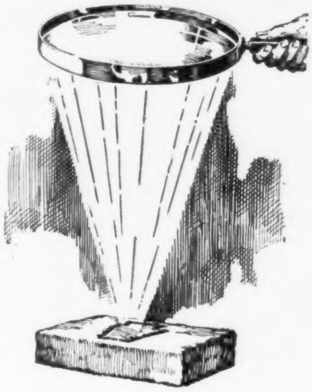

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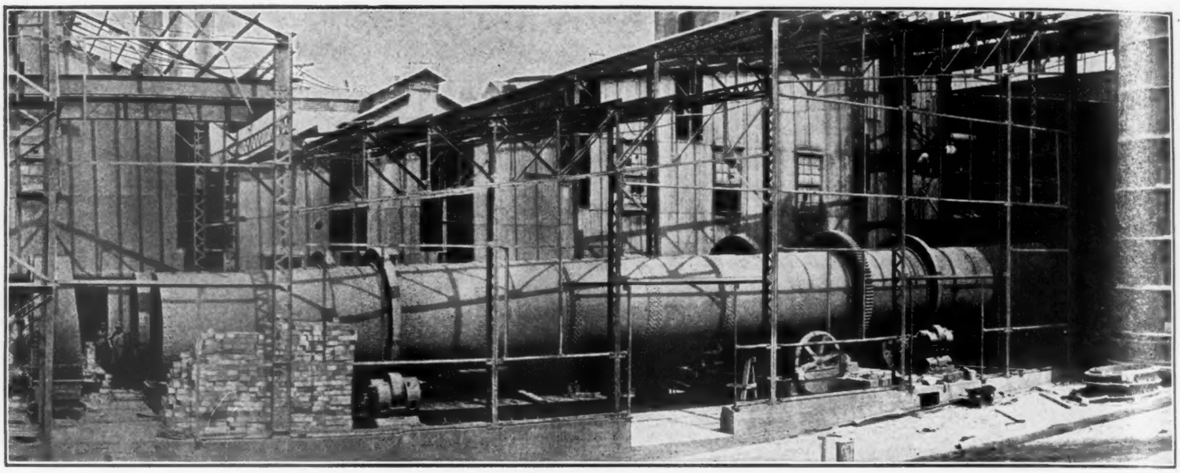

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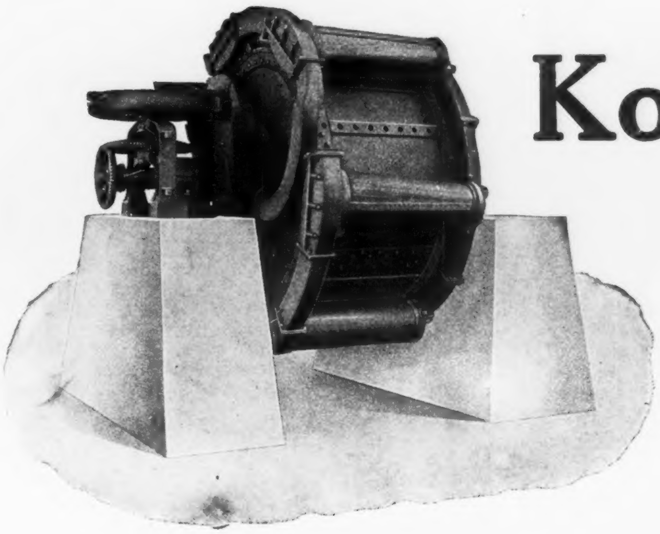

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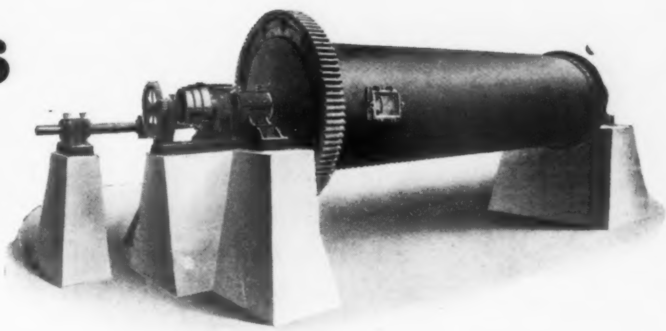

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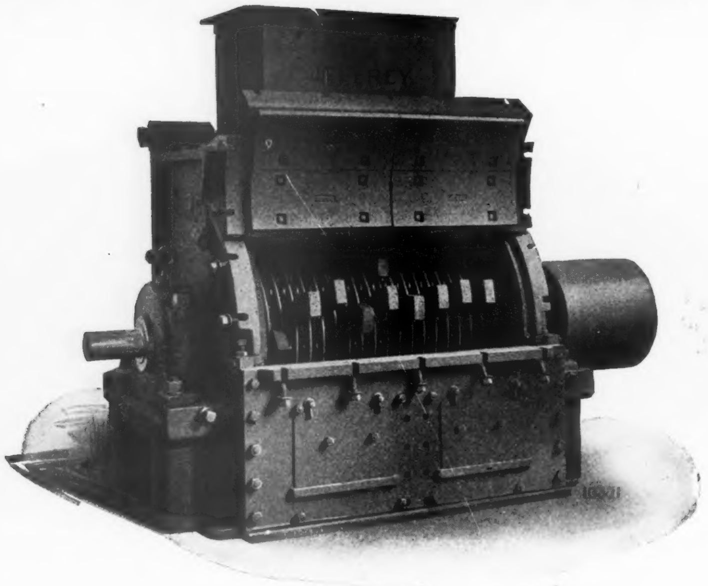

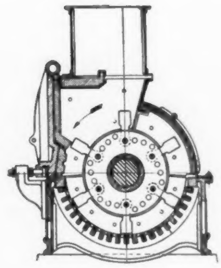

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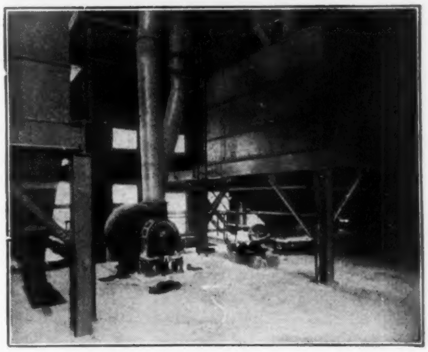
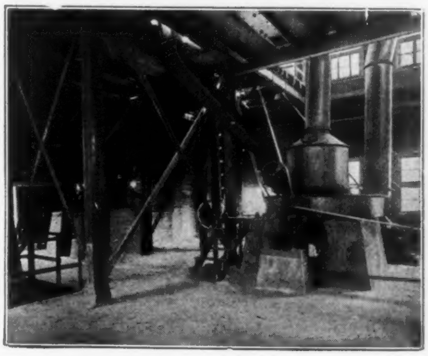


Raymond Special Exhaust Fan Direct Connected to Motor



Raymond Roller Mill with Gypsum Dryer in Background at Left

Stamina

22 hours per day from March to December, 1922, is the record of continuous operation established by 3 Raymond Roller Mills installed for the Empire Gypsum Co. of Garbutt, New York. Two of these machines were installed in 1912 and the third in 1922.

This seems unusual performance for pulverizing mills, but as a matter of fact, hundreds of concerns are getting the same reliable service from Raymond Mills handling such materials as Bauxite, Barytes, Clay, Coal, Hydrated Lime, Limestone and many other non-metallic minerals, as well as many manufactured products.

Furthermore, the finished products produced are fine and uniform, containing no oversize; no auxiliary equipment of any kind is required, and the operation is clean and dustless.

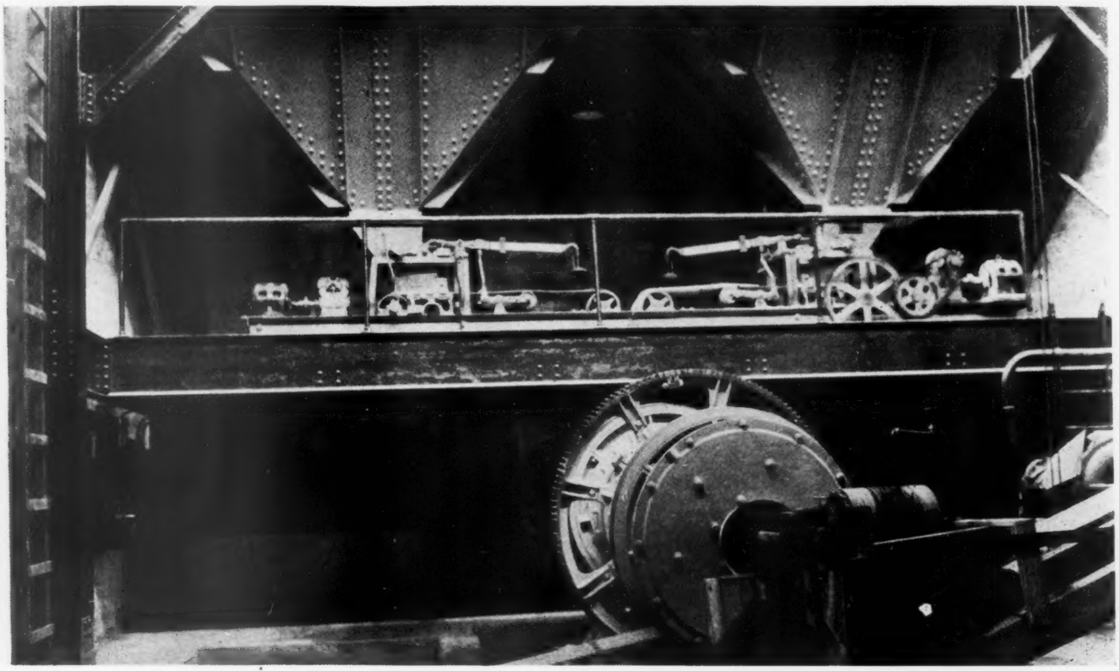
The Raymond System will do the same for you and save its first cost in a surprisingly short time.

Raymond Bros. Impact Pulverizer Co.

1301 North Branch Street Chicago, Ill.

Western Office: 1002 Washington Bldg., Los Angeles, Calif.
Eastern Office: 50 Church St., New York City

SCHAFFER Poidometers



A Vital Part of the Plant

In the manufacture of cement, the Schaffer will regulate the proportions of raw materials with minute exactness.

A simple regulation of its weight arm will take care of the varying composition.

The Poidometer is a simple machine for continuously, automatically and accurately weighing and regulating the supply of material. It is also made with an attachment for delivering a predetermined proportion of water to the amount of solids, or for delivering solids in proportion to liquids.

Our Bulletin will tell you how you can use the Poidometer.

Schaffer Engineering & Equipment Co.

2828 Smallman Street **Pittsburgh, Pennsylvania**